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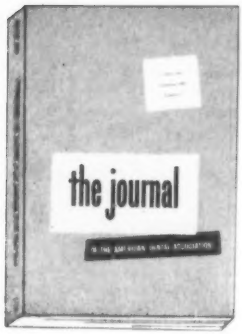

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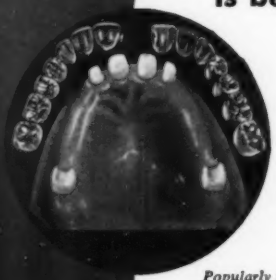

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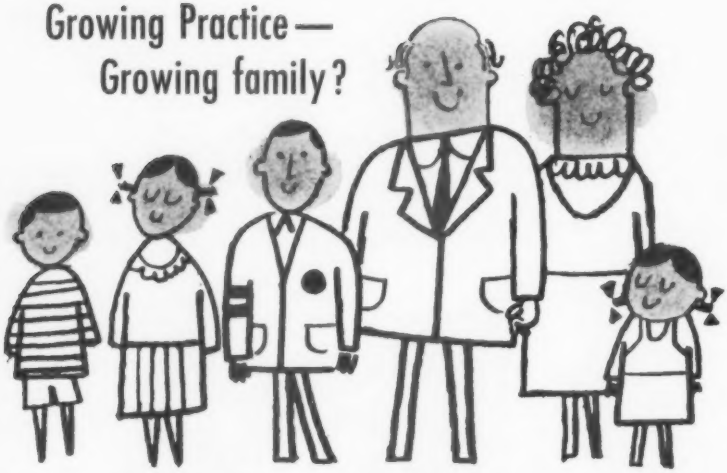

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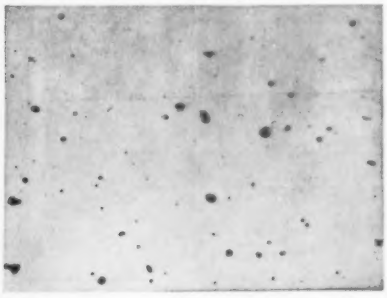
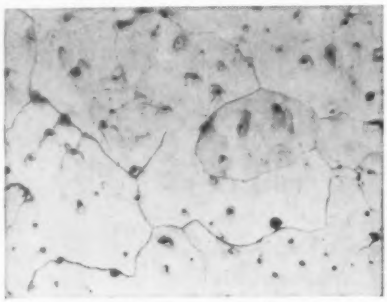
"The cause of fins can usually be traced to improper use of the investment. If too thin a mix of investment is used, it is likely to crack during burnout, causing fins and rough surfaces. Also, burning out before the investment has completely set will sometimes cause cracks and result in fins on the finished casting. The correct proportion of water and powder should be used and the investment allowed to set thoroughly before burnout is started.

"Since some of the fins were rather thick in cross section, there is also a possibility that the model coating was too heavy. The coating burned out, as well as the wax pattern, leaving a space over the teeth and between the ribs of the webbing. This space then became part of the mold cavity and was reproduced when the casting was made.

"To determine, if possible, why the clasp arms broke, a section of the casting was mounted and polished for metallurgical examination. The print below, taken at 100X, reveals the presence of gas porosity as indicated by the nearly round black areas which are actually holes in the casting.



"The print below, also taken at 100X, of the etched surface, shows the grain boundaries (fine dark lines) as well as the gas porosity.



"The size of the grain in this casting is somewhat large and in some areas the width of the grain boundaries is slightly greater than normal. Coarse grained material is not as strong as a fine grained material, and the wide grain boundaries usually indicate a contamination.

"To check on the possibility of contamination, part of the sprue button was melted on a charcoal block and cleaned up with a reducing flux. The metal could be cleaned and the button was rolled to a thin plate. This indicated that it probably was not contaminated with base metal; but rather oxides were present at the grain boundaries.

"The evidence is that the cause of a relatively weak casting, as evident by the clasp breakage, was due to a coarse grained casting further weakened by internal oxidation at the grain boundaries. These conditions were probably caused by overheating the metal prior to casting. Overheated metal will dissolve oxygen more readily and may cause oxide formation, gas porosity, as well as a coarse grained casting.

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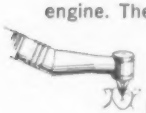

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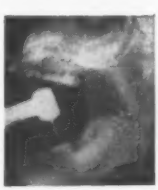

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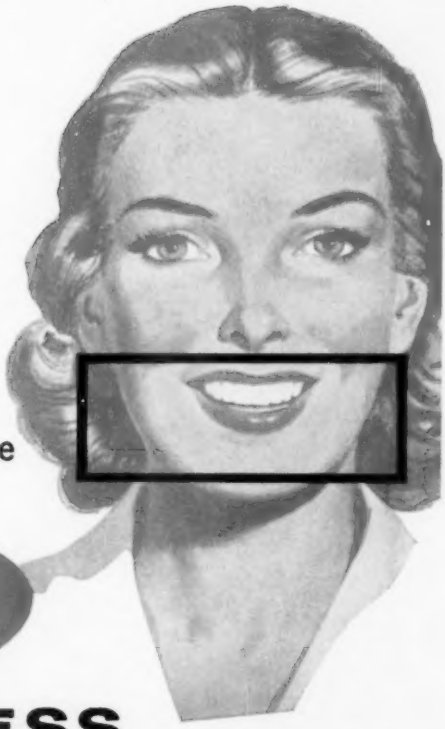

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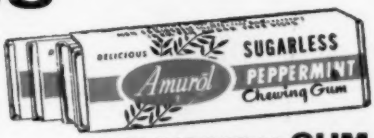

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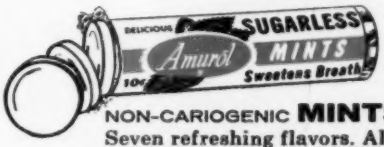

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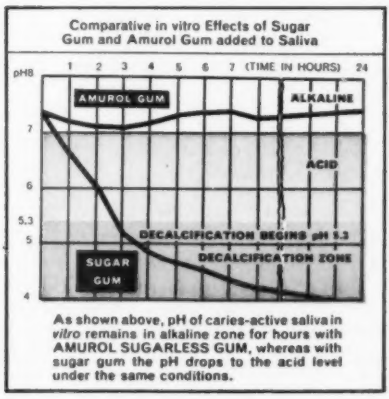

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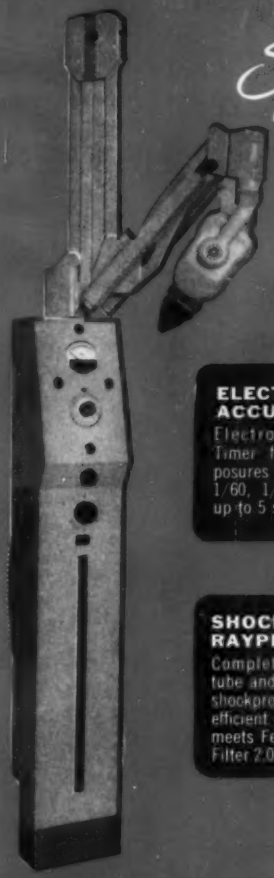

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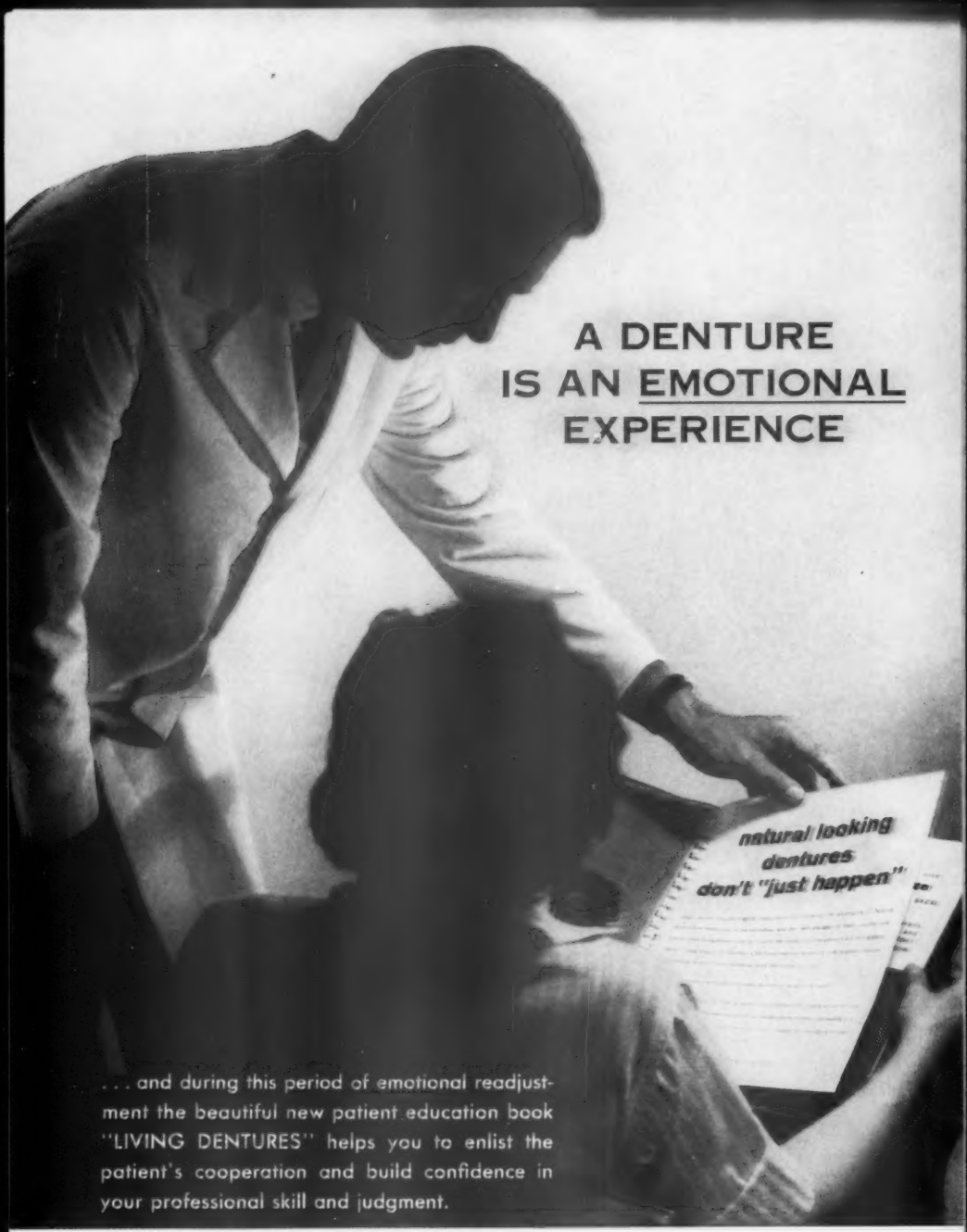

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A comparative study of the resorption of the alveolar ridges in denture-wearers and non-denture-wearers

R. Lyndsay Campbell, D.D.S., Washington, D. C.*

It is a moot question whether the wearing of dentures increases or retards resorptive changes in the alveolar ridges. A comparison of measurements of the alveolar ridges in two groups of institutionalized edentulous persons—of whom 38 wore complete dentures and 31 did not—resulted in the following observations: (1) in the lower jaw there was an apparent correlation between the wearing of dentures and smaller average vertical and labiolingual dimensions of the ridges; (2) in the upper jaw, the same relationship was apparent as to the labiolingual dimension of the ridges, but not the vertical; (3) no undue amount of ridge resorption was observed in ten persons with tertiary syphilis.

Whether resorptive changes in the alveolar ridges of edentulous persons are increased or retarded by the wearing of dentures is far from a settled question. Furthermore, though there are numerous and varied opinions on this subject, there is a paucity of studies with direct bearing on it.

Schlosser[1] seemed to imply that resorption of the edentulous ridges proceeds more rapidly when dentures are not worn, mentioning the "subsequently more gradual changes that go on after prosthetic dentures have been inserted." The means of retarding resorptive changes, according to Schlosser, include achieving good fit, correct vertical dimension and centric registration, and balanced occlusion.

Weinmann and Sicher[2] alluded to the same assumption, that resorption of the ridges ensues after the lack of stimulation when a prosthesis is not worn. They termed this phenomenon a typical disuse atrophy in which "loss of function . . . plays the decisive role. . . . If all the teeth have been lost and no denture is worn, the entire alveolar process gradually is resorbed."

It was noted by the same writers that this process may go so far as to include the resorption of parts of the body of the upper and lower jaws. In addition, they said that stresses which deviate from the normal or are in excess of the limits of tolerance of the tissues, bring about resorption of the bone; whereas, those within the limits of physiological tolerance and applied in the direction of the normal forces of the particular region stimulate bone apposition.

Pendleton[3] observed that the most common idea of the reaction of the jaws to the support of dentures, is one of bone degeneration and destruction. He reported on 126 biopsies from edentulous patients, 86 of whom had no dentures and the remainder of whom wore partial or complete dentures. He found that, to all intents and purposes, the tissue changes were the same in all three types and he therefore questioned whether the wearing of dentures is the greatest cause of resorption. He attributed the changes in the supporting tissues to injury or stress imposed on unhealthy conditions of the tissues, such as former periapical and periodontal disease associated with the natural teeth. If residual inflammation were checked, Pendleton believed, atrophic processes would be negligible in jaws stimulated by satisfactory dentures. Although he pointed out that resorption occurs when the circulation in the region is increased (as from constant increased pressure), he concluded that the intermittent pressure of mastication is compatible with a normal blood flow.[4]

Orban,[5] in like manner, commented in a symposium on bone resorption that pressure and inflammation stimulate resorption of bone tissue. Many writers, such as DeVan,[6] agree that alveolar bone is a perfect example of true bone. However, an opposing idea recurrent throughout the literature is that the alveolar process is a special type of bone; Chase,[7] for instance, was of the opinion that it is absorbed by chemical removal of the mineral matter, such as occurs in rickets and osteomalacia.

Several investigators have associated resorption of the ridges with the general systemic condition of the patient, rather than with the wearing or nonwearing of dentures. Thus, McCall[8] advanced the theory that precocious alveolar destruction is caused by vitamin C and D deficiencies in infancy. As a result of a roentgenographic series on hypocalcemic bone, McKevitt[9] ascribed this condition to a diet poor in calcium, or to hyperparathyroidism, and noted the subsequent severe atrophy of this type of bone if used to support dentures. Recently, it was noted that a prolonged tryptophan deficiency induced progressive osteoporosis of the alveolar bone in rats.[10]

Opposed to the aforementioned opinions, two often asserted views are that either denture wearing per se or poor fit of dentures is responsible for most ridge resorption. For instance, Slack[11] blamed such damage on the shock-transmitting tendencies of porcelain teeth, which change the occlusal relationship and thus lead to further resorption. Tissue destruction was ascribed by other writers[12,13] to faulty impression-taking technics, especially those which displace the soft tissues; to the "valve" action of dentures with too tight post-dam and peripheral seal; or to unbalanced occlusion.

Furthermore, Thompson[14] studied serial cephalometric roentgenograms of patients with complete or partial dentures in whom the bite has been unintentionally opened beyond the physiological rest position of the mandible. Comparisons

more than a year later revealed that the supporting bone had gradually resorbed until the normal vertical dimension and freeway space were again established. This convinced Thompson that "good" or "poor" bone had nothing to do with resorption in these patients.

Meanwhile, few direct attempts have been made to assess by measurement the sequelae of denture wearing. Wright[15] reported in 1929 on 200 newly edentulous patients with full mouth prostheses, 125 "experienced" denture-wearers, and 350 patients with upper dentures only. Special measuring calipers were used to measure the height in millimeters of the maxillary and mandibular ridges. No difference was noted in the average height of the ridges between recent and long-term denture-wearers. However, it was observed that 79 per cent of the "experienced" denture-wearers exhibited "flabbiness of the tissues," whereas this was true of only 30 per cent of those with recently constructed prostheses.

The Dento-contourograph[16] and the comparator[17] have been used to make comparisons of casts for various purposes, such as the investigation of the resorption of alveolar ridge tissue under immediate dentures. However, no one, insofar as can be determined, has specifically measured the alveolar ridges of denture-wearers as contrasted with those of non-denture-wearers.

MATERIALS AND METHODS

The subjects for the present study were two groups of institutionalized persons, long edentulous. The first group, of 38, had worn complete upper and lower dentures since the loss of their teeth. The second group, of 31, had either never worn dentures or, in a few instances, had not done so since entering the institution many years previously. Among the denture-wearers, three had had complete dentures for more than 21 years and the remainder had worn dentures for varying periods of time, of which the shortest was five years in one instance. Among the non-denture-wearers, six had been fully edentulous and without prostheses for more than 21 years, one had had his teeth extracted three years before the start of the study, and the others had been edentulous and without dentures for periods varying between the two extremes. The dentures in use at the time of the investigation were made of acrylic resin.

All patients in the two groups had been hospitalized as mental patients for from five to 25 years in the same institution. The majority (51) were suffering from the mental illnesses usually classed as functional; the minority, (16) from those of organic origin. Of the latter (by coincidence, five from each group) ten had cerebral syphilis with negative serologic findings at the time of this study. As recorded in the dental histories, periodontal disease was the chief cause for loss of teeth. Mental regression and incompetence accounted for the inability to wear dentures.

Upper and lower impressions were taken of each patient, using an alginate material and poured-in dental stone (Duroc). Particular attention was paid to obtaining accurate, muscle-trimmed impressions. The alveolar ridges of the resulting models were given a preliminary evaluation by the author, the amount of resorption being recorded as "slight," "mild," "moderate," "severe," and "very severe." This was felt to be a necessary adjunct to the measurement of the casts, as certain aspects of the over-all pattern of ridge resorption cannot be judged from dimensions alone.

Direct measurements in millimeters were then made of the vertical and labiolingual dimensions of the ridges, with measuring calipers at stated points on the upper and lower models. On the maxillary casts, a measurement of height was made at the anterior midline between the uppermost limit of the mucolabial fold, at the point directly to one side of

the labial frenum, and at the crest of the ridge. A measurement of the labiolingual dimension was made at the midline over the thickest portion of the ridge. On the mandibular casts three measurements were taken anteriorly at the midline in a similar manner, one of the labiolingual dimension of the ridge and two of its vertical dimension. Of the latter, one was made on the labial side from the mucobuccal fold at its deepest point to the crest of the ridge, and the other on the lingual side from the sublingual sulcus to the crest of the ridge.

Finally, readings were made on the maxillary models, using the occlusal analyzer.[18] This instrument was designed to project the normal occlusal position in relation to three landmarks: the right and left hamular notches and a point on the periphery adjacent to the labial frenum (the point directly below the anterior nasal spine). The originators of this device for use in prosthetic work were of the opinion, as a result of comparative data from human skulls, that the foregoing are fixed points of reference with relation to each other and other parts of the cranium. They believed them to be not subject to the changes which take place during the resorption of the alveolar process. Measurements were made, therefore, between the ridge of a model oriented on this instrument and the occlusal plane (as located by the device), to indicate the amount of resorption which had occurred. This was done by mounting the model of the edentulous maxilla so that the anterior movable finger of the instrument fitted into the point corresponding to the anterior nasal spine. The latter point, after being located by intraoral palpation at the furthermost reflection of the mucolabial fold, was marked with indelible pencil and thus transferred to the cast. The posterior components of the device engaged the hamular notches.

The movable platform representing the occlusal plane was then brought into position below the model at the level of a marker on the anterior finger 22 mm. from its tip. Measurements were made in millimeters between sites at specified intervals on the ridges and the presumed plane of occlusion. These measurements were at the midline, over the right tuberosity, at an arbitrary point 30 mm. along the ridge to the left of the midline, at the point of greatest resorption of the ridge, and at the point (apart from the tuberosities) where the least resorption was exhibited.

RESULTS

The results of the preliminary survey are summarized in Table 1. The mean length of time that dentures had been in use by the 38 patients who wore dentures was 13.6 years, with an interquartile range of 11 to 17 years. The mean length of time since becoming totally edentulous for the 31 patients who had no dentures was 15.2 years, with an interquartile range of 10 to 19.5 years.

As Table 1 shows, the amount of resorption of the maxillary ridges was judged to be slight, mild or moderate in half (19) of the group of 38 denture-wearers; whereas slightly more than half (17) of the non-denture-wearers were placed in these categories. The ridges of the other half of the denture-wearing group were considered either severely or very severely resorbed, whereas slightly less than half (14) of the non-denture-wearers were so classified.

However, a far greater discrepancy between denture-wearers and non-denture-wearers was observed in the lower models. Here, slight, mild and moderate designations accounted for only nine of the denture-wearers, as opposed to 18 of the much smaller group of non-denture-wearers. In addition, the condition of 30 denture-wearers, as opposed to 14 non-denture-wearers, was recorded as severe or very severe. It must also be noted that of the group judged very severe, 23 wore

Table 1 • Results of preliminary survey showing resorption of maxillary and mandibular ridges

Subject	No.	Amount of resorption				
		Slight	Mild	Moderate	Severe	Very severe
Maxillary ridges						
Denture-wearers*	38	9	4	6	11	8
Non-denture-wearers†	31	4	4	9	10	4
Mandibular ridges						
Denture-wearers*	38	1	0	7	7	23
Non-denture-wearers†	31	4	2	11	10	4

*Mean number of years of having worn dentures: 13.6; fifty per cent wore dentures betwen 11 and 17 years.

†Mean number of years of not wearing dentures: 15.2; fifty per cent were without dentures between 10 and 19.5 years.

dentures and only four did not. In fact, more than two thirds of the denture-wearers had severe or very severe resorption, and 12 of the 14 patients in whom an extremely thin, knifelike condition of the ridges was found were included in this group.

Table 2 gives the results obtained by direct measurement of the upper ridges. The mean height for the denture-wearing group was 13.0 mm., with a standard deviation of 2.91 mm.; whereas that for the non-denture-wearing group was 13.7 mm., with a standard deviation of 2.33 mm.

To determine whether the observed difference of 0.7 mm. between the averages for the two groups was of statistical significance,[19] the standard error of the difference was calculated and, from it, a "t" value of 1.1 was obtained. Since this value on the Student's "t" graphs falls well below the 5 per cent level, it was assumed that 0.7 mm. was not a significant difference.

The labiolingual dimensions of the upper ridges were compared in the same manner. The mean value for the denture-wearing group was 9.1 mm., compared with 10.8 mm. for the non-denture-wearing group. This difference of 1.7 mm., with a "t" value of 4.25, was found above the 0.1 per cent significance level and was therefore statistically highly significant.

Table 3 contains a similar set of data for the lower ridges. The mean height of the mandibular ridges of denture-wearers was 5.59 mm., and that of non-denture-wearers was 8.54 mm. The "t" value was well above the 0.1 per cent significance level, thus presumably classing as highly significant the difference of 2.95 mm. between the figures for the two groups. In the labiolingual dimension, the mean for the lower ridges of the non-denture-wearers (6.39 mm.) was 1.55 mm. greater than that (4.84 mm.) for the denture-wearers. With a "t" value above the 1 per cent level, this result also was statistically significant.

Since general systemic conditions are considered by some to be reflected in the reactions of the alveolar bone, a comparison was carried out among the ten tertiary syphilitics who happened to be among the 69 subjects of this study. The results, recorded in Tables 4 and 5, showed no differences great enough to be of statistical significance.

The results of the evaluation of the upper casts with the occlusal analyzer, together with their "t" values and sta-

Table 2 • Results of direct measurement of maxillary ridges

Subject	Number	Degrees of freedom	Mean (mm.)	Variance
Vertical dimension				
Denture-wearers	38	37	13.0	8.45
Non-denture-wearers	31	30	13.7	5.44
	69	67	Diff. = 0.7	
Standard error of the difference = 0.62 t = 1.1, d.f. = 67, P > .05 (not significant).				
Labiolingual dimension				
Denture-wearers	38	37	9.1	2.90
Non-denture-wearers	31	30	10.8	2.74
	69	67	Diff. = 1.7	
Standard error of the difference = 0.40 t = 4.25, d.f. = 67, P < .001 (highly significant).				

tistical significance, are recorded in Table 6. It can be noted that at the midline, at the site of the greatest amount of apparent alveolar ridge resorption, and at the site of the least amount of apparent resorption, the mean distance between the crest of the ridge and the projected plane of occlusion was greater for denture-wearers than for non-denture-wearers, an indication that in these particular spots denture-wearers seemingly underwent greater resorption of the ridges. However, the opposite was true of the "30 mm." and "right tuberosity" positions, and all of the differences lacked significance when analyzed according to the Student's "t" graphs.

DISCUSSION

The results of this investigation reveal certain tendencies of the relationship of complete artificial dentures to the status of the residual alveolar ridges. In the mandible, for instance, there was an apparent correlation between the non-wearing of dentures and larger mean vertical and labiolingual dimensions of the ridges and therefore, presumably, a lesser amount of ridge resorption. In spite of the fact that those who did not wear dentures had been, on the average, edentulous longer than those who wore dentures, the direct measurements of the mandibular casts showed not only a greater height for the ridges of non-denture-wearers, but a higher labiolingual dimension as well. Moreover, taking into consideration the relative number of subjects in each of the two groups, the preliminary survey also disclosed better preservation of the ridges in the non-denture-wearers.

In the maxillary ridges, a less conclusive picture was found. Although direct measurement yielded higher mean values (in both the vertical and the labiolingual dimensions) for those without dentures than for those with dentures, only the difference for the labiolingual figures proved to be statistically significant. It must be recalled, however, that in the science of statistics, nonsignificance is equivalent not to a definite verdict against, but merely to one "not proven."[19]

The results of the preliminary survey

were in accord with the foregoing findings. More denture-wearers than non-denture-wearers were placed in the category of "slight" resorption, but the same was also true of the class of "very severe" resorption. Because of the greater number of persons in the denture-wearing group, these differences would appear to be of little consequence. Finally, the data obtained using the occlusal analyzer appeared to substantiate the fact that there was no appreciable over-all difference between the mean heights of the maxillary ridges in denture-wearers and non-denture-wearers.

One question which would be raised by the outcome of this study concerns the idea of Weinmann and Sicher and also of Pendleton on the subject of "disuse atrophy" of edentulous jaws when prostheses are not worn. The observation that non-denture-wearers averaged less resorption of the mandibular ridges and, at least in one dimension, of the maxillary ridges, would suggest that this entire subject is definitely in need of more extensive investigation.

The statements of Weinmann and Sicher and Pendleton on alveolar ridge resorption are qualified to some extent by references to proper fit of the dentures, a factor difficult to assess. However, the well-known fact that curing shrinkage[20] and water sorption,[21] (which are responsible for continuing dimensional changes in the denture base, affecting both fit and retention) are characteristic of all acrylic resin dentures, would tend to nullify this qualification. So-called "good fit" is a fleeting phenomenon. Presumably, all acrylic resin dentures, because of inherent dimensional instability, could at some time be considered responsible for what is described in the literature as forces in excess of the physiological tolerance of the tissues. This emphasizes the need for a controlled study of the changes which take place under denture bases made of various materials and for research directed toward the development of a more satisfactory denture base material.

Furthermore, there is the consideration of what exactly is meant by "good fit," that is, whether it is the expression of the

Table 3 • Results of direct measurement of mandibular ridges of denture-wearers and non-denture-wearers

Subject	Number	Degrees of freedom	Mean (mm.)	Variance
Vertical dimension				
Denture-wearers	38	37	5.59	11.03
Non-denture-wearers	31	30	8.54	7.17
	69	67	Diff. = 2.95	
Standard error of the difference = 0.72 $t = 4.0$, d.f. = 67, $P < .001$ (highly significant).				
Labiolingual dimension				
Denture-wearers	38	37	4.84	3.50
Non-denture-wearers	31	30	6.39	3.51
	69	67	Diff. = 1.55	
Standard error of the difference = 0.45 $t = 3.4$, d.f. = 67, $P < .01$ (significant).				

Table 4 • Measurement of the maxillary ridges of syphilitics as compared with those of nonsyphilitics

Subject	Number	Degrees of freedom	Mean (mm.)	Variance
Vertical dimension				
Denture-wearers	33	32	12.7	8.02
Syphilitic denture-wearers	5	4	14.9	6.44
	38	36	Diff. = 2.2	
Standard error of the difference = 1.15 $t = 1.91$, d.f. = 36, $P > .05$ (not significant).				
Labiolingual dimension				
Denture-wearers	33	32	9.1	3.07
Syphilitic denture-wearers	5	4	9.2	1.78
	38	36	Diff. = 0.1	
Standard error of the difference = 0.82 $t = 0.12$, d.f. = 36, $P > .05$ (not significant).				
Vertical dimension				
Non-denture-wearers	26	25	13.5	5.97
Syphilitic non-denture-wearers	5	4	14.8	1.76
	31	29	Diff. = 1.3	
Standard error of the difference = 1.14 $t = 1.14$, d.f. = 29, $P > .05$ (not significant).				
Labiolingual dimension				
Non-denture-wearers	26	25	10.8	2.99
Syphilitic non-denture-wearers	5	4	10.9	1.44
	31	29	Diff. = 0.1	
Standard error of the difference = 0.82 $t = 0.12$, d.f. = 29, $P > .05$ (not significant).				

exact conformity of the denture base to the underlying tissues or whether it refers to maximum retention, as in a new acrylic denture which is warped, or a denture with heavy post-dam and peripheral seal.[22] Moreover, fit, however "good," might be an unimportant factor if there were in operation concurrent unphysiologic stresses leading to bone resorption. The work of Thompson[14] dealing with the re-establishment of the normal vertical dimension and freeway space through the resorption of bone under dentures illustrates rather dramatically certain conditions under which denture-wearing can bring about rapid destruction of the ridges.

Since the main reason for the removal of the teeth of patients in this study was periodontal involvement, according to

Table 5 • Measurement of the mandibular ridges of syphilitics as compared with those of nonsyphilitics

Subject	Number	Degrees of freedom	Mean (mm.)	Variance
Vertical dimension				
Denture-wearers	33	32	5.56	13.40
Syphilitic denture-wearers	5	4	5.00	4.15
	38	36	Diff. = 0.56	
Standard error of the difference = 1.68 $t = 0.33$, d.f. = 36, $P > .05$ (not significant).				
Labiolingual dimension				
Denture-wearers	33	32	4.63	2.43
Syphilitic denture-wearers	5	4	4.80	0.45
	38	36	Diff. = 0.17	
Standard error of the difference = 0.70 $t = 0.24$, d.f. = 36, $P > .05$ (not significant).				
Vertical dimension				
Non-denture-wearers	26	25	8.40	8.15
Syphilitic non-denture-wearers	5	4	9.95	2.33
	31	29	Diff. = 1.55	
Standard error of difference = 1.32 $t = 1.17$, d.f. = 29, $P > .05$ (not significant).				
Labiolingual dimension				
Non-denture-wearers	26	25	6.65	4.60
Syphilitic non-denture-wearers	5	4	6.20	0.56
	31	29	Diff. = 0.45	
Standard error of the difference = 0.98 $t = 0.46$, d.f. = 29, $P > .05$ (not significant).				

Pendleton's residual inflammation theory, it was to be expected that all the patients would be subject to similar atrophic tendencies. However, the fact that discrepancies were found to exist between the denture-wearing and non-denture-wearing groups would appear incompatible with such an idea. For this reason, plus the fact that these institutionalized persons presumably ate the same food over a long period of years, the influence of diet would tend to be ruled out as an important factor.

An opportunity to illuminate the problem of the effects of systemic disease on the alveolar bone was afforded here by the ten tertiary syphilitics included in the series. Since in no instance was there a statistically significant deviation in the mean for these patients from that of the

Table 6 • Measurements of maxillary alveolar crest and plane of occlusion

Subject	Number	Degrees of freedom	Midline	"30 mm."	Tuberosity	Most resorbed	Least resorbed
Denture-wearers	38	37	16.5	16.3	13.0	17.8	15.0
Non-denture-wearers	31	30	15.6	16.8	13.4	17.6	14.6
Difference			0.9	0.5	0.4	0.2	0.4
Standard error of the difference			0.66	0.64	0.38	0.63	0.61
			1.36 (not significant)	0.75 (not significant)	1.05 (not significant)	0.31 (not significant)	0.65 (not significant)

nonsyphilitics in the corresponding category, no undue amount of tissue destruction can be correlated with the presence, or former presence, of this disease.

Why the mandibular ridges in both the vertical and the labiolingual dimensions and the maxillary ridges in the labiolingual dimension only should have shown significantly greater resorption among denture-wearers than among non-denture-wearers (as opposed to no appreciable difference between the two groups in the vertical alveolar dimension of the maxillary ridges) is an interesting subject for speculation. If it can be assumed that stresses from denture-wearing beyond the limits of tolerance lead to tissue resorption, then the maxilla (of which a proportionately greater surface area is covered by the denture base than is true in the mandible) would be the seemingly more logical site for retardation of resorption. In the mandible, on the other hand, relatively more of the stresses are borne by the ridges. It might be maintained also that the lower jaw, because of the general tendency to poorer fit in lower dentures, would be subjected to more so-called unphysiologic forces.

It also must be recalled that several patients who were no longer capable of wearing dentures at the time the impressions were taken possibly had worn them for a short time in the past. Therefore, it is conceivable that in the absence of this circumstance there might have been a more pronounced discrepancy between the results for the two groups.

One of the other variables to be taken into account arises from the difficulty of establishing fixed landmarks on edentulous casts to use as a basis for measurements. Undoubtedly, serial cephalometric roentgenography would have been the method of choice for this type of study if the patients had been cooperative and facilities available.

SUMMARY AND CONCLUSIONS

Comparisons were made by means of measurements of the alveolar ridges in two groups of edentulous persons, 38 who wore complete dentures and 31 who did not, with the following conclusions and observations:

1. In the lower jaw there was an apparent correlation between the use of dentures and lesser mean vertical and labiolingual dimensions of the ridges.

2. In the upper jaw the same relationship was apparent in regard to the labiolingual dimension of the ridges, but not the vertical.

3. No significant difference in the amount of ridge resorption was observed in ten tertiary syphilitics.

4. The results suggest the need of further investigation of the causes of

alveolar resorption and the nature of alveolar bone, as well as the question of "disuse atrophy" when dentures are not worn.

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Necessity for Animal Experimentation • As between man and animals, man comes first. This is the law of life. But when man uses or destroys animals for man's own protection, aid, and other needs, such use must be conducted without cruelty. Certainly it cannot be immoral to use animals humanely to mitigate human suffering due to disease, as long as we believe animals may be sacrificed for human food and clothing. If man is not worth more than the dog, then our effort to improve man is an error. And we had better start raising more dogs and destroying more men, women and children for the good of the dog, so that the canine species may inherit the earth. *Anton J. Carlson.*

Mouth preparation for the removable partial denture

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The success of a removable partial denture is based on the dentist's meticulous attention to all phases of oral diagnosis and treatment planning, mouth preparation, construction of master casts, final survey and design, education of the patient, and insertion and maintenance of the denture. Modification of the remaining teeth should provide the partial denture with adequate support, stability and retention within the physiological limits of the supporting structures.

The preparation of the mouth for the removable partial denture follows the oral diagnosis. This diagnosis is made after taking a history of the patient, examining all oral structures and recording all observations. In addition to the study and evaluation of full mouth roentgenograms, the testing of the vitality of the remaining teeth is indicated. Study casts properly related to each other should be oriented on an adjustable articulator. The bases of these casts should be so prepared, prior to mounting on the articulator, that the casts may be removed and replaced accurately on the articulator mounting. This will allow the casts to be studied with a dental cast surveyor. With these aids in oral diagnosis, a tentative treatment plan can be formulated for the partial denture.

Failure to complete the study outlined and the subsequent steps in a thorough, systematic and conscientious manner results in an unsuccessful dental prosthesis. Conditions not previously observed arise later to interfere with the correct completion. Thus the denture is constructed with a series of compromises. The denture may function with fair success. However, after a year or two, valuable teeth are damaged beyond repair and will be lost. Naturally the blame for this failure is incorrectly placed by the patient on the removable partial denture. Each phase of partial denture construction is of equal importance.

The general health of the patient should be considered. The effects of diabetes mellitus, tuberculosis and diseases resulting from endocrine and hormonal imbalances should be studied. The effects of such diseases on the stability of the supporting bone are well-known. The additional stresses induced by the partial denture on the supporting structures of such patients usually accentuate the rate of loss of the supporting structures. Deferral of the dental treatment plan until adequate medical treatment has been effected is indicated. Nutrition of the aged patient should be reviewed,

studied and the necessary changes made before instituting treatment of the dental condition.

The local oral conditions which require treatment may be grouped under the following dental fields: oral surgery, periodontics, orthodontics, endodontics and operative dentistry. Only correction of the remaining teeth by operative procedures will be discussed, because of limited space.

LOCATION OF STUDY CAST AND DENTAL CAST SURVEYOR

The path of insertion should have been decided on in accordance with esthetics or mechanics, or a compromise between these factors, when surveying the study casts. This path of insertion should be recorded on each study cast by one of two methods; (1) three widely separated vertical scratch lines on the sides of the cast, parallel to the surveyor blade, as advocated by Applegate,[1] or (2) three widely separated points located on the cast. These points should be located in the same horizontal plane on teeth or tissue resistant to displacement. Either method will assure the repositioning of the study cast in the same plane used for the previous evaluation. Thus the same path of insertion will be maintained for future studies.

Some dentists prefer to make a list of surfaces to be ground or to mark with coloring material the various areas of the cast to be corrected. This method suffices to record the areas requiring correction of interferences, excessive tooth contours and unfavorably located height of contours. However, if the modification by grinding of these areas is not completed properly, the procedure fails to accomplish the desired result. For this reason, it is recommended that the dental cast surveyor, with the study cast mounted in a holder in its proper plane, be placed close to the patient at the time of the mouth preparation. The dentist should examine on the study cast the area of the tooth where the surveyor blade contacts, and also notice the size of the undesirable undercut located between the surveyor blade and the tooth at the gingiva. The proper disk or dental stone should be applied to the same area on the patient's tooth, being certain that the contact with the tooth is in the same area, and that the undesirable undercut is the same magnitude as observed on the study cast. After obtaining the proper position, the dental engine is started. Also, since it is impossible for the dentist to reposition his instrument once the modification of the area has started, an effort should be made to complete the correction of the area before removing the disk or stone.

MODIFICATION OF ABUTMENT TEETH

Posterior Abutment Teeth Not Requiring Restorations • The preparation of abutment teeth not requiring restorations is usually completed by grinding of enamel or existing restorations with dental stones, disks and other suitable instruments. A tooth restored with a good condensed amalgam restoration should not be replaced with an inlay, if its proximal contour is excessive. Most often the major amount of tooth surface modification occurs on the proximal surface. In maxillary teeth the height of contour often is located too near the occlusal surface on the buccal or labial aspect. In mandibular teeth the height of contour often is located too near the occlusal surface on the lingual aspect. When correcting the proximal tooth surfaces adjacent to edentulous regions, it is well to extend the modification around the tooth so that these surfaces are barely included. If occlusal rests are prepared in posterior teeth without proper proximal tooth surface preparation, the height of contour of the tooth is often on the same level as the occlusal rest. This results in two undesirable conditions:

1. Excessive space between the proximal surface of the abutment tooth and the adjacent part of the denture. A detrimental debris trap, as well as an unsightly space, is formed.

2. Failure to provide an area for the metal casting to contact the tooth. When the wax pattern is formed for a metal casting on the refractory investment cast with a height of contour near the occlusal surface, the wax pattern gingival to such a contour must be placed over the material used to eliminate the undesirable undercut. No contact between the metal casting and the proximal tooth surface is attained. Occlusion with opposing teeth often prevents placing the metal casting in a more occlusally located position.

No intent is made to recommend that the entire proximal surface be so modified as to be parallel to the path of insertion. However, if the occlusal 2 to 3 mm. of the proximal surface is parallel, a more satisfactory removable partial denture will result. Often the cause of a painful abutment tooth, after the insertion of a partial denture, can be traced to lack of proper contact of the casting to the proximal region.

In addition to these areas of such abutment teeth, other excessive contours may require modification by grinding. Often such correction will materially aid in placing both the reciprocal and retention clasp arm on the same level in relation to the abutment. Regions commonly requiring modification are as follows: (1) buccal and labial surfaces of maxillary teeth, (2) lingual surfaces of mandibular bicuspids and molars, and (3) the fifth cusp of maxillary molars. All areas requiring modification by grinding should be highly polished.

After completion of the grinding, and not before, the occlusal rests should be prepared. Failure to prepare the proximal tooth surface before preparing the occlusal rest, often changes the outline form of the occlusal rest to an undesirable shape. Many descriptions have been applied to the desired form, such as "spoon-shaped," "one half ball," and "ball bearing." Regardless of the term used by various authors, all agree that the rest preparation should incline toward the center of the tooth forming an angle of 90 degrees or less. In order to provide adequate bulk for the occlusal rest, which is to seat into the rest seat preparation, the marginal ridge should be reduced. However, this reduction should not make the marginal ridge the lowest part of the preparation. The lowest part of the preparation should be over the marginal ridge in the fossa. The occlusal rest should gradually decrease in size as it passes over the marginal ridge, so that at its termination in the fossa it is the approximate size of a no. 6 round bur. Such areas are best polished with a dull, round bur revolving at moderate speed. Since the fossae of mandibular teeth are located more toward the lingual aspect, it is better to place the rest slightly toward the buccal surface. Thus, more tooth structure is removed from the buccal side of the fossae than from the lingual side. The reverse applies to the location of the fossae in maxillary teeth and their preparations.

Posterior Abutment Teeth Requiring Restorations • The decision governing the extent of coverage of abutment teeth is individual in each instance. Often, full coverage of abutment teeth with crowns is the correct procedure. However, for the next patient who has a low caries index and excellent oral hygiene habits, such coverage is not indicated. The preparation of teeth for inlay or partial crown coverage of abutments should be well extended into the regions susceptible to recurrent caries. The importance of the extension of the abutment restoration should not be underemphasized.

Modern indirect technic, using hydrocolloid, polysulfide rubber base or silicone impression materials, help the den-

tist in making accurately aligned and designed castings for abutment teeth. All abutments should be recorded in an impression of the dental arch, so that the contours of each may be studied in relation to the other with the surveyor. Removable dies of all prepared abutment teeth are advisable as an aid in constructing properly contoured wax patterns. Areas of the pattern which are to be nonretentive in form for the partial denture casting may be trimmed with the surveyor blade to provide surfaces parallel to the path of insertion. Retentive contours may be located as desired and developed to the exact degree indicated.

The lingual side of the wax pattern for an abutment tooth may be modified with a lingual shoulder. This will permit the lingual clasp-arm of the partial denture casting to restore the lingual surface of the abutment tooth to its normal contour. Tongue comfort to the patient is especially noticeable when such a modification is accomplished in the bicuspid region.

The preparation of the occlusal rest always should be properly formed, shaped and developed in the wax pattern. Its desired form and shape should be spoon-shaped, as previously described. Thus the dentist knows, before cementing the restoration, that ample metal supports the occlusal forces transmitted by the occlusal rest of the partial denture casting to the metallic restoration. When an abutment restoration with an improperly shaped and formed occlusal rest area is cemented, the dentist may find that penetration through the casting to the tooth occurs when the occlusal rest area is reshaped.

Anterior Abutment Teeth • The modification of anterior teeth may be accomplished by several methods. The main requirement of the abutment teeth is to provide adequate support for the partial denture. Forces transmitted to the abutment teeth should be parallel to the long axes of such teeth, thus avoiding lateral stress.

The incisal rest, believed to be described first by Hardy,[2] is an excellent modification. Its use is more suitable to the lower cuspids than to maxillary cuspids. In maxillary cuspid abutments, the opposing incisal edges of the mandibular teeth may interfere with the junction of the metallic incisal rest and the body of the clasp. The one disadvantage of this type of rest is that its location is far from the periodontal attachment of the tooth. Thus, lateral forces transmitted by the partial denture casting to the abutment tooth are magnified, when compared to those of a rest placed closer to the periodontal attachment. The use of an incisal rest for patients having a lowered periodontal attachment is contraindicated.

The incisal rest is prepared by using a knife-edged disk or stone applied to the incisal edge of the abutment. The point of preparation should be one-third the distance from the distoincisal angle to the summit of the cusp if a distoincisal rest is desired, or one-third the distance from the mesioincisal angle to the summit of the cusp if a mesioincisal rest is desired. The notch should be carried well over into the labial and lingual plate. The depth of the notch should be ample to provide for adequate thickness of metal to resist occlusal forces, with the metal rest restoring the tooth to original contour.

The cingulum rest is employed only in teeth with well-developed natural cingula. Such crowns usually have greater than average labiolingual thickness, and the lingual aspect inclines more toward the horizontal. Seldom, if ever, is a tooth of such shape encountered except in the maxillary cuspid. Only a few maxillary cuspids have this form. However, when all these conditions are present in the abutment tooth, the cingulum rest is the one of choice. Great mutilation of abut-

ment teeth occurs when the dentist attempts to place the cingulum rests in improperly shaped abutments.

Preparation for the cingulum rest consists of reducing the distal marginal ridge slightly by grinding, to allow space for metal. The lingual ridge located incisally from the cingulum should be reduced to a greater degree. Care must be exercised to remove only enamel from the cingulum toward the incisal aspect, so as to accentuate the cingulum, thus creating an area for the metal rest. The base or floor of such a prepared rest should be less than 90 degrees in relation to the tooth's long axis. After the modification, all prepared areas should be polished.

The metallic restoration for anterior abutment teeth may be of several different types, only two of which will be discussed.

Where full coverage is indicated, the full cast gold crown is the abutment of choice. However, the esthetic requirements of the anterior and bicuspid teeth dictate that such crowns be of porcelain or acrylic veneer. Areas of retention in such crowns should be developed in the metal portion, with the veneer portion located occlusally or incisally to the height of contour. Abutments properly aligned with the path of insertion will prevent the display of unsightly interproximal spaces. Rest areas in abutments should be located as close to the gingiva as possible and direct the applied forces parallel to the tooth's long axis. In some abutment crowns an overdeveloped cingulum will provide an ideal rest area. In maxillary anterior teeth where a steep overbite is present, an overdeveloped cingulum is rarely present. In these conditions, the rest area must be created below the surface of the restoration. The general shape of the rest area as described previously should be developed. Steep vertical side walls are to be avoided in the rest areas of clasp-type removable partial dentures.

When partial coverage is indicated, the partial crown or inlay may be used. The formation of the rest area should be completed in the wax pattern, as previously described. When such anterior teeth are used as abutments, it is well to be positive that the retention area of the tooth is in an area which can be used by the retentive clasp arm. It is most embarrassing to restore a mandibular cuspid with a three-quarter crown restoration and then later discover that no retentive form is available for the location of the flexible clasp terminal.

OTHER MODIFICATIONS

Mention should be made of the outstanding success and response of abutment teeth to splinting. Weak abutment teeth possessing inadequate periodontal support will give years of service when splinted together with metallic restorations.

A description of mouth preparation would not be complete without briefly mentioning the occlusion to be established with the opposing dental arch. Extruded teeth, which prevent normal mandibular movements, must be corrected, either by simple grinding, grinding of the extruded portion and protection by a restoration, or by removal. The degree of extrusion usually governs the treatment. It should be noted that maxillary posterior teeth, as they migrate occlusally, usually tend to move in a buccal direction. As a result, lingual cusps are more pronounced after such migration. The reverse applies to mandibular teeth. The opposing teeth which have failed to erupt to their normal occlusal plane should be built to the plane with metallic restorations.

SUMMARY

The success of a removable partial denture depends on the dentist's meticulous and conscientious completion of all phases. Oral diagnosis and treatment planning, mouth preparation, securing of

accurate master casts, final survey and design, education of the patient, insertion and maintenance of the dental prosthesis are all of equal importance.

Mouth preparation may encompass all fields of dentistry. The importance of modification of teeth by grinding and polishing, or cast restorations to harmonize with the path of insertion of the denture, has been discussed. These modifications should provide the partial denture with adequate support, stability and retention within the physiological limits of the supporting structures. Modifications of the opposing occluding surfaces are indicated to aid in establishing proper occlusion. A removable partial denture made in accordance with these principles is not the forerunner of a complete denture, but maintains oral tissues and health.

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The retention of dentures

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More than muscular and occlusal forces are involved in the retention of a denture. There is a third force, which may best be understood by analogy with a physical system involving the resistance to displacement of two flat circular plates with the plane surfaces parallel and horizontal, and separated by a space containing a fluid. The algebraic equation for "parallel plate plastometry" is given, and applied to the components which help to produce denture retention. The equation helps to explain certain clinical procedures in prosthetic dentistry. The accurate reproduction of detail on denture bases does not seem desirable.

When the mouth is open and muscular or occlusal forces are not retaining the denture, its lack of movement shows the operation of some other source of retention that could contribute to stability under other circumstances. The explanation has not been found from direct experimentation. Inspection and clinical observations may be grossly misleading.

ANALOGY

There is, however, a physical system that can be compared to dentures that are either being pressed on to mucosa or being separated from the mucosa. The similarity of the shape and circumstances,

and of the physical law associated with the system and clinical observations, suggests an analogous relationship: Two flat circular plates with the plane surfaces parallel and horizontal are separated by a space containing a fluid. The plates may be totally immersed in fluid or the fluid may be between the plates only. If a force directed at 90 degrees to the plane surfaces tends to separate these plates, a difference in pressure between the center and the periphery causes flow of the fluid toward the center. The difference in pressure arises from the lag, caused by the viscosity, in the filling of the increasing volume between the separating plates. The rate of separation of the plates will depend on the force, and the rate of flow of the fluid; the latter depends on the viscosity of the fluid and the geometry of the system.

A mathematical description for this system was derived and tested by Stefan[1] in 1874 and since has been obtained by others,[2-7] using different bases and technics. It has been verified experimentally, and acceptable corrections have been applied to previous experiments to improve the agreement between theoretical and experimental values. The formula is not altered significantly by the direction of movement; the plates may come together or move apart.

The following arrangement of Stefan's equation (see appendix) facilitates this discussion:

$$f = \frac{2\pi r^4 c}{4h^3 t} + \frac{2\gamma}{h}$$

where f is the force upon one plate,

r is the radius of the plates,

c is the viscosity,

h is the distance between the plates after the interval of time, t,

γ represents surface tension.

The effects of surface roughness and wetting of the plates by the fluid are dealt with separately.

Analysis • During displacement, the force tending to maintain any particular separation is equal to, but opposite in sign to, f. The values of f, and any fluctuations thereof, are measures of what is called, in this application, the retentive force. This retentive force is a reactive force developed during displacement. The effect of varying one symbol on the right-hand side of the equation upon the value of f shows the following influences upon the value of the retentive force:

1. γ, surface tension: An increase in the surface tension of the fluid increases the retentive force. The component which is due to surface tension diminishes as the separation becomes greater; this is a result of a decrease of the pressure within the fluid by the meniscus, if the fluid is of aqueous nature. Total immersion of the plates in the fluid removes this component.

2. c, the viscosity: As the viscosity of the fluid increases, the retentive force increases proportionally, for the rate of centripetal flow of the fluid depends on the viscosity and the geometry of the system. The pressure difference is greater or remains longer with more viscous fluids.

3. r, the area: The retentive force increases with an increase in the area of the plates.

4. h, the separation: The retentive force decreases in proportion to the square of the separation.

5. t, the time: As the displacing force continues in time, the retentive force diminishes.

Surface Roughness and Wetting • Rough surfaces on the plates decrease the value of f; the "hills" enforce a minimum value for h without a commensurate effect on the restriction of flow which can occur in the "hollows." When the fluid remains in isolated drops on the plates, the value for f drops; this is probably because of changes in flowing and cohering properties. The effectiveness of long-range mo-

lecular forces on adhesion of liquids to plates, (and thus as a component of denture retention) can be doubted; the presence of an apparently stagnant layer of fluid on a plate is related to the heights of the "hills" rather than to some molecular phenomenon or forces.[8]

CLINICAL OBSERVATIONS

1. When the removal of a seated denture is attempted, the resistance to withdrawal increases with the pull exerted on the denture. The retentive force is thus a reactive force.

2. A post-dam and a strong peripheral seal increase the retention, which may be altered by lifting the lip away from the flange. Centripetal flow of saliva or air has been prevented by the seal.

3. Holes in the denture decrease retention. Air flows more readily than saliva, and the pressure difference is thus offset.

4. The use of relief areas and "vacuum" chambers decreases retention.[9] Such spaces increase the separation in circumscribed areas and may entrap air beneath the denture; the ready expansion of such air prevents the development of noticeable pressure differences (Boyle's law states that pressure times volume is a constant).

DISCUSSION

Acceptance of the hypothesis that the described physical system is a good analogy and that the associated physical law can be used to describe denture retention without any notions of quantitative values being assigned, allows explanation and understanding of denture retention. The aptness of such explanations supports the choice of the analogy still further.

Retention other than that due to muscular or occlusal forces can be described as a phenomenon associated with flow. As the denture moves, or tends to move, away from the mucosa, the increasing volume beneath is filled by the flow of air or saliva from the periphery. All features that impede flow increase retention, and vice versa.

The peripheral edge of the denture and the flanges develop a one-way valve. The soft, movable, clinging tissues of lips, cheeks and lingual floor, and the post-dam regions permit the egress but not the ingress of saliva and air. Fish's concavities[10] also may increase the effectiveness of the valve; the undoubted benefit of these cannot be a result of tissues pressing against the flange, for such pressure creates as much dislodging as retaining force.

The area of contact of denture and mucosa should be as large as possible, consistent with muscular function and soft tissue movement if good retention is the object. The distance from periphery to center over which flow must occur before separation is possible, is thus increased. The importance of the proximity of the base and tissue, (that is, fit) can be shown; flow occurs less readily in narrower spaces. This has nothing to do with molecular adhesion, for, as Bikerman[8] has shown, the amount of various liquids left on a variety of plates of varying roughness is related to the degree of polish or rugosity, and not to molecular structure or forces.

Surface tension of saliva is of minor importance under ordinary circumstances. A patient's loss of dentures while swimming may be because surface tension will not operate in a mouth full of water, and the viscosity of saliva will be decreased. The meniscus, when it does exist, may aid retention by holding the flaccid tissues and forming a one-way valve with the flange.

Thick saliva impedes centripetal flow and thus increases retention. However, the drop in viscosity of saliva during mastication and drinking does not seem to alter retention noticeably. But after a short time in the mouth a proteinaceous

layer on the surface alters the surface properties, and wetting occurs. The improvement of retention two to three hours after insertion of the denture may be in part a result of the wetting by saliva of a recently processed or well-cleaned denture; this alters the system as noted before.

Soft flabby tissues beneath the denture base impair retention and yet fit may be better than where firm, resilient tissues exist beneath. Flabby tissue offsets decreases in pressure, for the tissues in effect will flow. The ready movement of the denture and soft tissues away from the alveolar bone may break the peripheral seal.

The role of atmospheric pressure in denture retention can be shown. The retentive force during separation of the plates is caused by the difference in pressure beneath the plates and the surrounding pressure, be it atmospheric or hydrostatic; however its value does not depend on the surrounding pressure or circumstances, because the physical law operates equally well for plates approaching one another. The difference in pressure and thus the flow of the fluid between the periphery and the center are unaltered by the surrounding atmospheric circumstances. Changes in atmospheric pressure[11] may affect retention indirectly through changes in the tone of muscles.

CONCLUSIONS

The preceding analysis shows that atmospheric pressure, surface tension and molecular adhesion do not singly or collectively explain denture retention. Dubious entities such as interfacial surface tension do not provide an explanation. The problem is associated essentially with the flow of fluids within a certain system. Variations in degree of retention of dentures are attributable to features of design; that is, changes in the geometry of the system. All that impedes flow between the denture and mucosa beneath aids retention. The ingress of air decreases retention, for air flows more readily than saliva.

Accuracy for the sake of fit is desirable. The preservation of detail on the anatomical surface by increasing the roughness will do little for retention, for flow is not impeded. This surface roughness may have harmful effects. A denture perfectly accurate in dimension and detail may harm the underlying soft tissues by mechanical irritation and by the protective effect on tissues whose health depends on the scouring effects of food.

Through the understanding of the way in which clinical features work in relation to retention, the importance of the following is emphasized: peripheral seal, concave contours of nonanatomical surfaces, post-damming, maximum extension consistent with movement of tissues about the periphery, and the accuracy of the denture base.

SUMMARY

A well-verified physical relationship is postulated as a good analogy to explain denture retention. The system chosen and explained is that of two plates separated by a layer of fluid; they may be either in air or immersed in a fluid. The resistance to their separation is shown to be caused by the rheological properties within that system; that is, a relationship between the flowing properties of the fluid and the geometry of the system.

Clinical observations and the similarity of shape and situation of the plates and dentures make the analogy acceptable. The purpose of certain clinical procedures in prosthetic dentistry may then be explained. The accurate reproduction of detail on denture bases does not seem a desirable aim.

APPENDIX

Two circular plates of radius r, with their plane surfaces parallel and the space between filled with a fluid of viscosity, c,

are acted upon by a force, f, normal to the plates. The separation increases from h_1 to h_2 in the interval of time, t. Stefan[1] and others[2-7] have stated that:

$$\frac{dh}{dt} = \frac{2fh^3}{3\pi cr^4}$$

and thus, Equation 1,

$$t = \frac{3\pi cr^4}{4f}\left(\frac{1}{h_1^2} - \frac{1}{h_2^2}\right)$$

A suitable approximation is

$$ft = \frac{3\pi cr^4}{4h^2}$$

where h is the separation at time, t. Surface tension[12] will alter the value of f, as in

$$\left(f - \frac{2\gamma}{h}\right)t = \frac{3\pi cr^4}{4h^2}$$

where γ represents surface tension.

Such equations are based upon the major assumptions that no flow occurs on the surface of the plates and that the vertical velocity of the fluid may be neglected.

Dienes and Klemm[6] claim that at the low rates of shear[13] obtaining in such a system, fluids therein will behave as simple or Newtonian fluids, and thus derivations may be based upon Newton's law of flow.

The limit to the value of f as the plates are separated is determined by the hydrodynamic properties of the fluid; at high rates of separation or with large displacing forces, cavitation will occur within the interposed fluid. This alters the system and the relationships no longer hold.

Equation 1 is not altered if the plates are approaching.

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Books • We ought to regard books as we do sweetmeats, not wholly to aim at the pleasantest, but chiefly to respect the wholesomest: not forbidding either, but approving the latter most. *Plutarch.*

The microbiology of plastic dentures

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In an investigation of the microbiology of plastic dentures, flora was recovered from the tooth sockets of worn dentures. The predominating bacteria (streptococci, staphylococci and lactobacilli) found were considered part of the resident flora of the oral cavity. Members of the transient flora seldom were recovered. Acrylic and vinyl copolymer plastics used in dentures did not inhibit the growth of bacteria isolated from denture sockets. A bacterium smaller than any of the resident microorganisms did not penetrate thin sheets of acrylic or vinyl copolymer plastics. Odors that occur in some dentures may be attributed in part to the resident flora of the tooth sockets of dentures.

The microbial flora of the oral cavity has been studied extensively. At least 29 species of microorganisms have been isolated from the oral cavity,[1] the population levels varying from time to time and within individuals.[2] Most of these organisms are transients and reside in the oral cavity for only a limited time. Other microorganisms appear to be lifelong residents and are known as the resident, or indigenous, flora. The streptococci, staphylococci and lactobacilli are included in this latter flora.

The effect of plastics on the oral microbial flora, to our knowledge, has never been reported, although Walter, and others,[3] found that plastics had no effect on similar microorganisms encountered in milk. To date, there have been no reports concerning the microbiology of plastic dentures.

In this study, the following were determined: the microbiologic flora of worn, plastic (acrylic and vinyl copolymer) dentures; the effect of plastics on microorganisms of the oral flora; the penetration of plastics by microorganisms; and the odors produced by bacteria of the predominant flora of denture sockets.

MICROBIAL FLORA OF DENTURE SOCKETS

The microbial flora of tooth sockets of the following types of dentures were determined: acrylic base with porcelain teeth; acrylic base with acrylic teeth; vinyl copolymer base with porcelain teeth; vinyl copolymer base with vinyl copolymer teeth. All of the dentures had been worn for several years and were obtained by dentists from their patients. The dentures were sent to the laboratory in separate, sterile containers, and were received with-

in 24 hours; the bacteriologic examinations were begun immediately.

Five teeth from each complete denture were extracted aseptically. In partial dentures, a representative number of teeth were removed. Samples for bacteriological analyses were obtained by scraping the inside of the sockets and pooling the scrapings from each denture in nutrient broth. Portions of such broths were transferred to microbiological media especially favorable for the growth of aerobic, microaerophilic and anaerobic bacteria; alpha, beta and gamma hemolytic streptococci; pneumococci; meningococci; gram-negative bacteria of the alimentary tract; gram-negative cocci *(Neisseria)* of the oral cavity; lactobacilli; actinomycetes; streptomycetes; fastidious pathogens; aciduric and acidophilic bacteria; yeasts and molds.

The following microbiologic media were used for isolation and identification: brain heart infusion broth; brain heart infusion agar; eosin methylene blue agar; Brewer anaerobic agar; dextrose broth; dextrose agar; azide dextrose broth; azide dextrose agar; peptonized milk; trypsin digest agar; tomato juice agar; APT broth; APT agar; veal infusion broth; anaerobic veal infusion agar; AC medium; MacConkey broth; MacConkey agar; Sabouraud liquid medium; Sabouraud dextrose agar; Emerson broth; and Emerson agar.

The results (Table 1) indicated that streptococci, staphylococci and lactobacilli were the bacteria most often isolated from the tooth sockets of plastic dentures. Yeasts and gram-negative bacteria were isolated from the sockets of a few dentures. Though microbiological media favorable for the growth of many groups of microorganisms were employed, other organisms were not recovered. The age of the denture did not appear to influence the microbial flora of the sockets.

It was not possible to obtain an accurate quantitative estimate of the number of bacteria in sockets of plastic dentures. However, the number of dentures from which the various groups of microorganisms (Table 1) were isolated, is shown in Table 2.

Streptococci and staphylococci were present in the sockets of an equal number of dentures. Lactobacilli were present in the sockets of one-third of the dentures, whereas yeasts and gram-negative rods were found in less than one-fourth of the dentures. The predominating groups of bacteria, therefore, were streptococci (alpha and gamma hemolytic), staphylococci and lactobacilli. Two of these groups, the streptococci and staphylococci, were isolated most often from dentures constructed with porcelain teeth. All three of the predominating groups of bacteria were isolated from the sockets of two acrylic dentures with porcelain teeth. In dentures constructed entirely of acrylic or vinyl copolymer plastics, the three predominating groups of bacteria never were isolated from the sockets of the same denture. The same groups were present, however, when all of the vinyl copolymer dentures were considered. In the all-acrylic dentures, staphylococci were not isolated.

EFFECT OF PLASTICS ON MICROORGANISMS

The possibility that acrylic and vinyl copolymer plastics had an inhibitory or a toxic effect on the growth of microorganisms was considered. Squares of plastic were placed on nutrient agar plates which previously had been inoculated with the predominant groups of microorganisms from denture sockets and with five species of bacteria representative of those usually found in the oral cavity.

Any area without growth around the plastic would be indicative of inhibition caused by the plastic material. The results are recorded in Table 3. Neither the acrylic nor the vinyl copolymer plastics used in dentures inhibited the growth of microorganisms.

Table 1 • Microorganisms isolated from denture sockets

Code no.	Denture		Age of denture (in years)	Microorganism isolated
	Base	Teeth		
VA-02	Acrylic	Porcelain	16	Streptococcus Staphylococcus Lactobacillus Yeast
VA-A3	Acrylic	Porcelain	7	Lactobacillus Yeast
VA-A3 lower	Acrylic	Porcelain	7	Staphylococcus
VA-A4 upper	Acrylic	Porcelain	7	Streptococcus Staphylococcus Lactobacillus Yeast
VA-A4 lower	Acrylic	Porcelain	7	Non
VA-A6 upper	Acrylic	Porcelain	8	Streptococcus Staphylococcus
VA-A6 lower	Acrylic	Porcelain	8	Streptococcus Staphylococcus
10 upper	Acrylic	Porcelain	8	Yeast
10 lower	Acrylic	Porcelain	8	Streptococcus
VA-L5 upper	Acrylic	Acrylic	3	Streptococcus Lactobacillus Yeast
VA-L5 lower	Acrylic	Acrylic	3	Lactobacillus
VA-0-16	Acrylic	Acrylic	—	None
11 upper	Vinyl copolymer	Porcelain	—	Streptococcus Staphylococcus Gram-negative rods
11 lower	Vinyl copolymer	Porcelain	—	Streptococcus Staphylococcus Gram-negative rods
BM-DL7 upper	Vinyl copolymer	Vinyl copolymer	—	Staphylococcus Lactobacillus
BM-DL7 lower	Vinyl copolymer	Vinyl copolymer	—	Staphylococcus Lactobacillus
BM-DL8	Vinyl copolymer	Vinyl copolymer	—	Gram-negative rods
WBE-1420 upper	Vinyl copolymer	Vinyl copolymer	7	Streptococcus
WBE-1420 lower	Vinyl copolymer	Vinyl copolymer	7	Streptococcus
ELW-3081 upper	Vinyl copolymer	Vinyl copolymer	2	Staphylococcus
ELW-3081 lower	Vinyl copolymer	Vinyl copolymer	2	Streptococcus Staphylococcus

Table 2 • Microorganisms in 21 dentures

Denture			Microbiologic flora					
			Number of dentures containing these flora					
Base	Teeth	Number examined	Streptococci	Staphylococci	Lactobacilli	Yeasts	Gram-negative rods	None
Acrylic	Porcelain	9	5	5	3	4	0	1
Acrylic	Acrylic	3	1	0	2	1	0	1
Vinyl copolymer	Porcelain	2	2	2	0	0	2	0
Vinyl copolymer	Vinyl copolymer	7	3	4	2	0	1	0

The survival of microorganisms isolated from tooth sockets of plastic dentures, and representatives of microorganisms usually found in the mouth, was determined. The test organisms were placed on sterile squares of plastic and maintained in a 37°C. incubator for seven days. Survival of the microorganisms on such surfaces was determined by subculturing the squares in liquid media favorable for growth of each respective microorganism. The results after 1, 2, 4 and 7 days are reported in Table 4.

On the surface of acrylic plastic, the predominating groups of microorganisms survived for one day, except for one strain of lactobacillus. The staphylococcus strain survived for two days. Microorganisms representative of the oral flora, obtained from the American Type Culture Collection, were used in an identical test. Such representatives of the predominating groups of microorganisms remained viable on the surface of acrylic plastic: *Streptococcus salivarius* survived for seven days; *Staphylococcus aureus* survived for four days; and *Lactobacillus acidophilus* survived for only one day. *Proteus vulgaris* and *Neisseria catarrhalis,* usually found in the oral cavity, though not isolated from any of the denture sockets, did not survive for 24 hours on acrylic plastic surfaces.

The results of the test of the survival of the same strains of microorganisms on vinyl copolymer plastic surfaces were similar. However, the strains of streptococci isolated from denture sockets did not survive for 24 hours. The staphylococcus isolate lived for seven days and one lactobacillus strain survived for two days. *Streptococcus salivarius* and *Staphylococcus aureus,* microorganisms representative of the oral flora, remained viable for seven and four days, respectively, on vinyl copolymer surfaces. *Lactobacillus aci-*

Table 3 • Effect of plastics on growth of microorganisms

Microorganism	Zone of inhibition	
	Plastic	
	Acrylic	Vinyl copolymer
Predominating groups		
Streptococcus D-3	None	None
Streptococcus D-5	None	None
Staphylococcus D-1	None	None
Lactobacillus G-2	None	None
Lactobacillus E-4	None	None
Representatives of oral flora		
Streptococcus salivarius	None	None
Staphylococcus aureus	None	None
Lactobacillus acidophilus	None	None
Proteus vulgaris	None	None
Neisseria catarrhalis	None	None

Table 4 • Survival of microorganisms on plastic surfaces

Microorganism	Plastic							
	Acrylic				Vinyl copolymer			
	Time in days				Time in days			
	1	2	4	7	1	2	4	7
Predominating groups								
Streptococcus D-3	+	−	−	−	−	−	−	−
Streptococcus D-5	+	−	−	−	−	−	−	−
Staphylococcus D-1	+	+	−	−	+	+	+	+
Lactobacillus G-2	+	−	−	−	+	+	−	−
Lactobacillus E-4	−	−	−	−	−	−	−	−
Representatives of oral flora								
Streptococcus salivarius	+	+	+	+	+	+	+	+
Staphylococcus aureus	+	+	+	−	+	+	+	−
Lactobacillus acidophilus	+	−	−	−	−	−	−	−
Proteus vulgaris	−	−	−	−	−	−	−	−
Neisseria catarrhalis	−	−	−	−	−	−	−	−

+ = Organism survived.
− = Organism did not survive.

dophilus, another representative of the predominating group of microorganisms, did not live on the vinyl copolymer surfaces. *Proteus vulgaris* and *Neisseria catarrhalis* did not remain viable 24 hours on such surfaces.

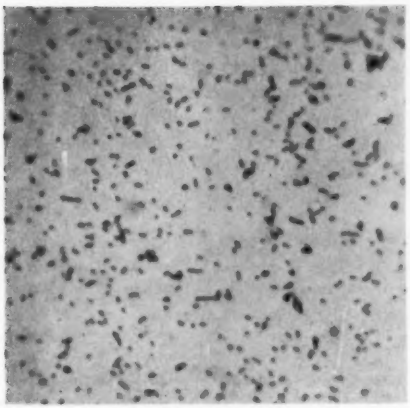
INFILTRATION OF PLASTICS

The infiltration of bacteria in acrylic and vinyl copolymer plastics was investigated to account for the presence of microorganisms within the sockets of the dentures. Aliquots from a broth culture of the test organism, *Achromobacter parvulus,* 0.1 to 0.2 microns by 0.3 to 0.5 microns in size (see illustration) were placed in cups, with squares of plastic averaging 0.050 inch in thickness serving as the bottom of the cup. At 1, 2 and 7 day intervals, examinations were made to recover the microorganisms from the opposite side of the plastic sample. The results at the end of the seven day period showed that there was no infiltration of the four types of acrylic plastic tested, and no infiltration of the three types of vinyl copolymer tested.

The results indicated that infiltration of acrylic or vinyl copolymer plastics by the test organism did not occur. It is unlikely that the predominating bacteria which are larger in size, (streptococci, 0.6 to 1.2 microns in diameter; staphylococci, 0.8 to 1.0 microns in diameter; and lactobacilli, 0.6 to 0.9 by 1.5 to 9.0 microns) than *Achromobacter parvulus,* gained access to the sockets by passage through the plastic. The test organisms remained viable throughout the test.

ODOR PRODUCTION BY PREDOMINANT FLORA

The possibility of odor production by the bacteria predominating in the sockets of dentures was examined. Representative strains of such microorganisms were placed in sterile, melted butter for 24 hours at 37°C., after which the mixtures



Achromobacter parvulus, rods 0.1 to 0.2 by 0.3 to 0.5 microns. Used in test of infiltration of plastics by bacteria

were smelled to detect odor. The presence (+) or absence (—) of odor is recorded in Table 5.

Strains of microorganisms isolated from the sockets of dentures, with but one exception *(Streptococcus D-3)*, produced odors in butter. The presence of such bacteria may account, in part, for odors in some dentures.

SUMMARY

An extensive investigation to isolate many groups of microorganisms from the tooth sockets of worn plastic dentures was conducted. However, only a very restricted flora was recovered. Streptococci, staphylococci and lactobacilli were the predominating bacteria (Tables 1 and 2). The presence of these groups in denture sockets is understood readily, since they are considered to be a part of the resident flora of the oral cavity. Growth of the microorganisms was not inhibited (Table 3) by either acrylic or vinyl copolymer, both of which are used as denture materials. The same predominating groups of microorganisms remained viable on the surface of acrylic plastics for at least 24 hours, a period well within the time between removal of the denture from the mouth and microbiologic sampling (Table 4). Fewer strains of microorganisms survived on the vinyl copolymer plastics, though representatives of each of the predominant groups remained viable for at least 24 hours. Bacteria considered to be members of the transient flora of the oral cavity *(Proteus vulgaris* and *Neisseria catarrhalis)* did not survive on either of the plastic materials.

The possibility that bacteria might infiltrate the plastics was considered. However, a bacterium *(Achromobacter parvulus)* smaller than any of the microorganisms of the resident flora did not penetrate thin sheets of acrylic or vinyl copolymer plastics within a seven day period.

Sockets of dentures constructed of plastic with porcelain teeth contained the predominating microorganisms more often than all-plastic dentures. In all-acrylic dentures (acrylic base with acrylic teeth), only streptococci and lactobacilli, of the resident flora, were recovered. The sockets of vinyl copolymer dentures with vinyl copolymer teeth possessed an even more restricted flora.

Odors were produced in butter by microorganisms representative of the predominating groups of bacteria which were isolated from the sockets of plastic dentures.

Table 5 • Odor production by predominating microorganisms

Microorganism	Odor
Streptococcus D-3	—
Streptococcus D-5	+
Staphylococcus D-1	+
Lactobacillus G-2	+
Combined cultures*	+
Butter alone	—

*Composed of strains of all four microorganisms.
+ = Odor.
— = No odor.

CONCLUSIONS

The predominating bacteria (streptococci, staphylococci and lactobacilli) found in tooth sockets of acrylic and vinyl copolymer dentures were those considered to be a part of the resident flora of the oral cavity. Members of the transient flora seldom were recovered from the tooth sockets. The predominant groups of microorganisms most often were recovered from dentures constructed of plastic with porcelain teeth. Acrylic and vinyl copolymer plastics used in dentures did not inhibit the growth of bacteria isolated from denture sockets, or of those representative of both the resident and transient flora of the mouth. A microorganism *(Achromobacter parvulus)* smaller than those usually inhabiting the oral cavity did not infiltrate thin acrylic or vinyl copolymer plastics during a seven day period. Regular, continuous exposure of plastic dentures to the oral microorganisms over long periods of time may account, however, for the infiltration of bacteria. Odors occurring in some dentures may be attributed, in part, to the resident flora of the tooth sockets of dentures.

From the studies of the microbiology and microscopy section of Mellon Institute conducted for the Fellowship on Dental Plastics sustained by Luxene, Inc.

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Football Injuries • The face presents the single body area most vulnerable to injury. Here fractured teeth are most common, with the causative agent being the opponent's foot (25 per cent), the head (18 per cent), the knee (16 per cent), and the arm (12 per cent). At a recent postgraduate conference, four outstanding college trainers seriously doubted the efficacy of present-day facial protection bars in reducing the incidence of facial injury; in fact, they felt that they might be responsible for a number of cervical sprains of the twisting type when grasped by an opponent, which frequently happens in spite of the 15-yard penalty rule. ***Donald B. Slocum, The Mechanics of Common Football Injuries. J.A.M.A. 170:1640 Aug. 1, 1959.***

Blood sampling and cultural studies in the detection of postoperative bacteremias

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Postoperative bacteremia was found within five minutes of maximal trauma in 28 of 34 patients requiring extractions (82 per cent), and in 29 of 33 periodontal patients (88 per cent) after curettage, gingivectomy and other periodontal procedures. Of 97 strains of microorganisms recovered from patients in both groups, 37 per cent were streptococci and 33 per cent were diphtheroids. There was no difference in the incidence of these microorganisms in the two groups of patients. The study confirms previous reports of the high incidence of bacteremia after dental extractions and demonstrates similar occurrences after various types of periodontal treatment. A greater variety of microorganisms, including fastidious and anaerobic species, has been recovered.

The occurrence of bacteremias in some patients immediately after certain dental operations is well recognized. Such occurrences are of obvious importance to the health of the patients concerned, particularly those individuals having a history of rheumatic heart disease, since valvular alterations are such that they are more prone to attacks of endocarditis.

Reviews of the literature by Robinson[1] and co-workers and Lautenbach and Linzenmeier[2] indicate that the reported recoveries of organisms from the peripheral blood after dental extraction varied from 16 to 73 per cent. Keosian, Weinman and Rafel[3] have recently reported a relatively low incidence of 27 per cent recovery of organisms during postextraction bacteremias, whereas Bender, Pressman and Tashman[4] demonstrated an 85 per cent recovery. There is little systematic information concerning the sequelae to certain periodontal treatments.

Historically, there has been a preoccupation with the probability of a relationship between streptococcal endocarditis and dental treatment. Indeed, Kraus, Casey and Johnson[5] have demonstrated satisfactorily the similarity of mouth streptococci to nonhemolytic streptococci recovered from patients having bacteremias of dental origin or from patients with subacute bacterial endocarditis. There are available, however, 91 references to endocarditis associated with organisms other than streptococci. It is well known, also, that the mouth harbors a wide variety of microorganisms in addition to the streptococci. Included are members of the family *Corynebacteriaceae*, the genera *Actinomyces, Veillonella, Fusobacterium, Bacteroides, Spirillum*

and *Vibrio,* among others, as well as numerous less well identified groups. In addition, Mazzarella, Hedman and Brown[6] have isolated a variety of fastidious, often anaerobic, microorganisms comprising these and other genera from the pulp canals of teeth with nonvital pulps, all of which had no exposed pulp canal, no deep carious lesions, no periodontal involvement and no history of severe trauma.

Since the organisms recovered by other investigators have been chiefly streptococci, it seemed probable that the application of modified blood sampling and cultural technics would enable the detection of bacteremias involving diverse groups of organisms.

METHODS

Culture Media • Three media, designated as CC, AS and SC were employed. Medium CC was trypticase soy broth (Baltimore Biological Laboratory) in which was included 0.1 per cent agar, 0.0043 per cent *p*-aminobenzoic acid, 0.7 per cent gastric mucin, 0.17 per cent sodium citrate and 0.033 per cent saponin. The latter two substances were included since Elliott[7] pointed out that they influenced considerably an increased recovery of streptococci from the peripheral blood during bacteremias. Except for the saponin and citrate, this medium is identical with one employed for routine blood culturing at the National Institutes of Health.

Medium AS was a modification of Huntoon's hormone medium which is used for the cultivation of spirochetes. Its preparation has been described in detail by Fitzgerald and Hampp.[8]

Medium SC was the same as medium AS except that 0.17 per cent sodium citrate and 0.033 per cent saponin were added.

The CC medium was dispensed in 170 ml. amounts into 200 ml. Erlenmeyer flasks, then sterilized in the autoclave. Media AS and SC were dispensed aseptically in 142 ml. amounts into presterilized 200 ml. Erlenmeyer flasks. Just prior to use, all flasks of media were heated in a boiling water bath to remove residual air. After cooling, 14 ml. of ascitic fluid and 14 ml. of a 1 per cent solution of glutathione were added aseptically to both AS and SC media. Aliquots of all media were incubated to insure sterility. The cotton stoppers were removed from all flasks of media and replaced with sterile rubber stoppers.

Patients • Two categories of patients were selected for study in the clinical investigations branch of the National Institute of Dental Research. One group required dental extractions, the other periodontal therapy. The latter group was included since there is little systematic information on bacteremias after deep scaling or other types of surgical intervention in the treatment of periodontal disease.

In the extraction series the teeth were removed with the patients under lidocaine anesthesia after diagnoses of advanced periodontal disease, pulpitis and other common conditions. The number of teeth extracted varied from 1 to 12, with a mean of approximately 4 per patient. The operations were performed by an oral surgeon who made a special effort to eliminate luxation or "rocking" since this technic had been shown by Elliott[9] to increase the incidence of postextraction bacteremias. This was accomplished by employing the buccal flap technic and by removing bone before any luxating forces were applied. In this group of patients, 1 had a history of rheumatic heart disease, 1 had emphysema, 1 had uveitis of 3 weeks' duration, and 1 was a 74 year old man suffering from hypertension and general debility. The remaining patients had normal medical histories. The data for the treatments, admitting diagnosis, as well as the organisms recovered, are listed for each patient in Table 1.

Table 1 • Extraction series

Case no.	Organisms recovered	No. teeth extracted	Remarks
1	Tetrad	4	One infected tooth; extensive alveolectomy
2	Diphtheroid; *Streptococcus*	3	Difficult extraction with more than ordinary luxation
3	Diphtheroid; *Streptococcus*	3	Periodontal disease
4	Tetracoccus; diphtheroid; *Streptococcus*	3	Periodontal disease
5	Diphtheroid; *Bacteroides*	1	Impaction
6	Negative	1	Periapical abscess (chronic)
7	Vibrio	2	Periapical infection (chronic)
8	Anaerobic small gram positive motile rod	2	Periapical infection (chronic)
9	Diphtheroid	3	Periodontal disease
10	*Streptococcus*	5	Periodontal disease
11	Diphtheroid; gram positive anaerobic small motile rod	6	Periodontal disease and gross caries
12	Negative	4	Heavy penicillin therapy 5 days preoperatively
13	*Streptococcus*	4	Periodontal disease
14	*Streptococcus*	4	Periapical pathology
15	*Actinomyces*	4	Periodontal disease
16	Negative	8	Caries and periodontal disease; roots of teeth exposed
17	*Streptococcus*	5	Rheumatic heart; patient sensitive to penicillin; tetracycline preoperatively; organism resistant to drug
18	Negative	7	Heavy preoperative erythromycin therapy
19	Diphtheroid	2	Periodontal disease; granuloma curetted from 1 tooth socket
20	Negative	4	Infected granuloma curetted; periodontal disease
21	*Streptococcus*	3	Periapical and periodontal infection; luxation
22	*Streptococcus*; diphtheroid	1	Pulpitis (acute)
23	*Streptococcus*	12	Uveitis; chloramphenicol preoperatively; organism resistant to drug
24	*Streptococcus*	6	Periodontal disease
25	Diphtheroid; tetracoccus; *Bacteroides*; *Spirillum*	6	Periodontal disease; periapical infection (chronic)
26	*Bacteroides*; *Spirillum*; diphtheroid; *Streptococcus*	4	Periodontal disease; periapical infection (chronic)
27	*Bacteroides*; *Streptococcus*	6	Periodontal disease
28	*Streptococcus* sp. 1; *Streptococcus* sp. 2	3	Extensive caries
29	*Streptococcus*; diphtheroid	5	Impacted teeth
30	*Streptococcus*; diphtheroid	7	Periodontal disease
31	Negative	3	Periodontal disease
32	*Actinomyces*; *Micrococcus*	1	Extensive caries
33	Diphtheroid	3	Periodontal disease
34	*Streptococcus*; *Actinomyces*	8	Caries and periodontal disease

The periodontal patients were diagnosed as having advanced periodontitis requiring curettage or periodontal surgery. In the curettage procedure, a special effort was made to remove all the ulcerated crevicular epithelium as well as the calcareous deposits. Lidocaine infiltration anesthesia was employed in all patients requiring periodontal surgery and only occasionally when curettage was required. The periodontal surgery consisted of one or more of the following procedures: gingivectomy, osteoplasty or flap operation. Patients who underwent the surgical procedures had been treated by curettage and had had gross occlusal adjustments done, where indicated, at previous visits. Not more than one quadrant was treated per visit. All patients in this group had a normal medical history.

Collection of Specimens • Blood samples were taken within five minutes after the clinician had judged maximal trauma to occur. Often this was done during the closing stages of an operation. The patient's arm, at the site of venipuncture, was painted with tincture of iodine. After a few minutes, the iodine was sponged off with 70 per cent ethanol. Venipunctures were performed by two of the authors, one a physician, the other a qualified dentist.

After 20 preliminary cases, the procedure outlined below was adopted. Forty-five milliliters of blood were obtained in a 50 ml. graduated syringe. Once the blood was drawn, the needle was removed from the syringe and the glass tip of the syringe was flamed. The sterile rubber stoppers sealing the media-containing flasks were removed, the interior rims of the flasks were flamed hot, and 15 ml. aliquots of blood were discharged into one flask each of the three media. The flasks were again flamed and the stoppers replaced. Thus, the final volumes were 170 ml. of medium and 15 ml. blood to make a total volume of 185 ml., leaving a relatively small air space in each of the 200 ml. flasks. A portable propane tank fitted with a Bunsen burner tip was used for all flaming operations.

Cultivation was essentially anaerobic by use of these procedures. This condition was chosen because it is becoming increasingly clear that the general oral flora is either anaerobic or microaerophilic. Even though certain organisms, such as lactobacilli and streptococci, can grow aerobically, growth is greatly improved under anaerobic or microaerophilic conditions.

A 10 ml. sample of blood was taken immediately before the initiation of surgical procedures, discharged into a single flask containing the CC medium and incubated under the same conditions as the postoperative cultures. In preliminary studies, the CC medium was found to be adequate for the growth of contaminating organisms from the skin or general environment.

Cultivation and Sampling • The flasks were incubated at 35° C. for a total period of two weeks. Unless the needs of the patient required the information sooner or unless the flasks appeared grossly positive, they were not sampled until after two days' incubation. Additional samples were taken whenever the flasks appeared positive. Otherwise samples were obtained on the sixth or seventh day.

Each flask was inspected carefully in transmitted light from a fluorescent lamp. Frequently, in positive samples only a single bacterial colony, or relatively few, could be seen. Routinely the colonies were aspirated into a Pasteur pipette fitted with a rubber bulb. Each specimen was examined by dark-field microscopy and Gram-stained smears.

At the same time, subcultures were made into medium AS, fluid thioglycollate medium (NIH modification), chocolate fluid thioglycollate, or any medium deemed appropriate or selective for the growth of the suspected genus, such as

the *Veillonella*.[10] All positive subcultures were plated until pure cultures were obtained. All flasks which appeared negative were examined after two weeks by dark-field microscopy and subcultivated through several transfers to ascertain that no growth had occurred.

In addition to the blood samples, a variety of oral samples were taken in 40 per cent of the patients. The samples comprised deep scrapings from periodontal pockets, swabs from isolated sockets, subgingival and supragingival calculus, soft tissue removed during periodontal surgery, apexes of extracted teeth, granulomas and similar specimens. These were cultured in a wide variety of media and a large group of microorganisms, tentatively resembling these isolated from bacteremias, was obtained. This phase of the work is to be the subject of a separate report.

RESULTS

Eighty-two per cent of the patients requiring extractions and 88 per cent of the periodontal patients had demonstrable bacteremias within five minutes of maximal trauma. Of particular interest is the high percentage of positive findings in the periodontal group. Previous workers have been more systematically engaged with the sequelae of oral surgery, but it appears from the present results that bacteremias occur as frequently after periodontal operations. In the present work bacteremias occurred at a frequency comparable to the highest of those previously reported. In addition, two or more varieties of organisms were isolated simultaneously in 44 and 67 per cent respectively of the patients requiring extractions and those requiring periodontal treatment.

Table 1 lists the 34 patients requiring extractions, the organisms recovered, the number of teeth extracted, the diagnosis, pertinent operative details and therapy. Of the six instances where findings were negative, two had received antibiotics five days preoperatively and also postoperatively. The total preoperative dosages of penicillin V and erythromycin per day, respectively, were 2,000,000 units and 800 mg. The remaining instances in which findings were negative were Cases 6, 16, 20 and 31. From these patients 1, 8, 4 and 3 teeth were extracted, respectively, and the diagnoses were periapical abscess, caries and periodontal disease with roots of teeth exposed, infected granuloma with periodontal disease and advanced periodontal disease. Examination of Table 1 or knowledge of operative details reveals no obvious reasons for these negative results, since bacteremias were found in many similar instances. Although two of the patients in whom there were negative findings had been pretreated successfully with antibiotics, it is noteworthy that Cases 17 and 23 had bacteremias in which streptococci were isolated after preventive treatment with 800 mg. of tetracycline and 1 Gm. of chloramphenicol per day.

Table 2 lists the 33 periodontal cases, the organisms recovered, and the operative procedures employed. In four instances the findings were negative and again there were no obvious reasons for this, since the oral pathological alterations and operative trauma were at least as great as in many similar instances in which organisms were recovered. No patients in the periodontal group were treated preoperatively with antibiotics.

Organisms were recovered preoperatively in two instances and the same organisms were also found postoperatively. Okell and Elliott[11] had a similar experience, since they found streptococci preoperatively in 10.9 per cent of a selected group of 109 patients with periodontal disease. In two of the present patients obvious contaminants were found; namely, large air sarcinae, 1 from a preoperative and 1 from a postoperative sample. Except for these isolated occasions, all other preoperative samples were sterile.

Table 3 summarizes the incidence of

Table 2 • Periodontal cases

Case	Organisms recovered	Remarks
1	Negative	Curettage
2	Negative	Granuloma excised, (periodontal)
3	*Streptococcus*, diphtheroid	Granuloma excised, (periodontal)
4	Diphtheroid	Preoperative sample also positive with same organism recovered postoperatively
5	Negative	Gingivectomy and flap sutures
6	Diphtheroid; *Actinomyces*	Preoperative sample also positive with same organism recovered postoperatively
7	Tetracoccus; diphtheroid	Granuloma excised, (periodontal)
8	*Bacteroides*, *Streptococcus*, diphtheroid	Granuloma excised, (periodontal)
9	Diphtheroid	Curettage
10	*Streptococcus*	Curettage
11	*Actinomyces*	Curettage
12	Diphtheroid	Curettage
13	*Streptococcus*	Gingivectomy
14	*Streptococcus*	Gingivectomy
15	*Streptococcus*; *Veillonella*	Gingivectomy
16	*Streptococcus*; *Spirillum*; *Actinomyces*	Gingivectomy
17	Negative	Curettage
18	*Streptococcus*; *Actinomyces*; *Fusobacterium*; diphtheroid; *Bacteroides*; *Veillonella*	Gingivectomy
19	*Veillonella*; *Streptococcus*; diphtheroid	Curettage
20	*Streptococcus*; *Veillonella*; diphtheroid	Curettage
21	*Bacteroides*; tetracoccus; *Streptococcus*	Granulation tissue excised, (periodontal)
22	*Streptococcus*; diphtheroid; *Fusobacterium*	Curettage
23	Diphtheroid; *Streptococcus*; small motile gram positive anaerobic rod; *Actinomyces*	Curettage
24	*Micrococcus*; *Leptotrichia*	Curettage
25	Diphtheroid; *Vibrio*	Curettage
26	*Fusobacterium*; *Streptococcus*, *Bacteroides*	Gingivectomy
27	*Streptococcus*; *Fusobacterium*	Gingivectomy
28	*Actinomyces*; *Bacteroides*; diphtheroid	Gingivectomy
29	*Fusobacterium*; diphtheroid	Curettage
30	*Actinomyces*; *Streptococcus*; *Spirillum*, small motile rod	Gingivectomy
31	*Fusobacterium*; *Bacteroides*; tetrad; probable *Veillonella*	Gingivectomy
32	*Streptococcus*; tetracoccus; *Fusobacterium*	Gingivectomy
33	*Streptococcus*; diphtheroid	Alveolectomy with gingivectomy

bacteremias in both groups of patients, the instances in which 1 organism was recovered, and those in which 2 or more different organisms were isolated from the same blood sample.

Table 4 summarizes the distribution and frequency of occurrence of the organisms isolated. There was no significant difference in the frequency with which streptococci or diphtheroids were recovered after either extractions or periodontal treatment. Streptococci were recov-

ered after 38 and 36 per cent of extractions and periodontal treatments, respectively; diphtheroids, after 28 and 32 per cent respectively. Rogosa, Shiota and Disraely (unpublished data) have found large populations of diphtheroids in oral samples. The growth of oral diphtheroids is favored by anaerobic or microaerophilic conditions, whereas the diphtheroids which inhabit the skin and are commonly encountered in blood culturing generally grow well aerobically and may even grow preferentially near the surface of liquid media. Furthermore, microscopically, these diphtheroids are often very short and coccoidal as contrasted with the general morphology of the oral types which are often difficult to differentiate from the actinomycetes. Of the remaining organisms which may be found on the skin, particularly the tetracocci and micrococci (staphylococci), tetracocci were found on several occasions. In specific instances they were isolated together with: (1) diphtheroid, *Bacteroides, Streptococcus;* (2) diphtheroid, *Streptococcus;* (3) diphtheroid; (4) *Bacteroides, Streptococcus;* (5) *Fusobacterium, Bacteroides, Veillonella;* and (6) *Streptococcus, Fusobacterium.* On only one occasion were they obtained unaccompanied by other organisms. The micrococci in the two instances in which they were isolated were found together with (1) *Leptotrichia,* and (2) *Actinomyces.* However, it is well to remember that tetracocci, *Gaffkya,* and *Micrococcus* are common inhabitants of the mouth and in the study of Mazzarella and coworkers[6] constituted 13 per cent of the organisms recovered.

It is striking that Mazzarella, Hedman and Brown[6] isolated streptococci and diphtheroids at incidences of 25 and 20 per cent, respectively. The ratio of streptococci to diphtheroids was 1.25, almost exactly that of 1.24 for the total number of patients in the present study. Especially interesting is the large variety of organisms, representing such genera as *Vibrio, Spirillum, Bacteroides, Veillonella, Fusobacterium,* and *Actinomyces* which were recovered in the present study. These are strictly anaerobic, fastidious, and consequently difficult to isolate and maintain in pure culture. In previous studies by others, anaerobic technics and optimal media for primary isolations and subcultures generally were not employed. Thus, these organisms could not be readily detected.

DISCUSSION

The present study confirms previous reports of the high incidence of bacteremias after dental extractions. It also demonstrates similar occurrences after various periodontal treatments. Furthermore, a greater variety of organisms have been recovered, particularly fastidious and anaerobic species. Lautenbach and Linzenmeier[2] have also isolated such microorganisms as *Actinomyces, Bacteroides, Fusobacterium* and *Veillonella,* although not with as relatively high frequency as in the present investigation. For the most part, the organisms recovered by previous investigators have been streptococci. For instance, Okell and Elliott[11] have reported an incidence of 60.9 per cent of bacteremias with streptococci as the sole organism. Members of the genus *Streptococcus* comprise one of the largest groups of organisms found in the mouth. The more frequent recovery of such organ-

Table 3 • Summary of bacteremia incidence

	Extraction series	Periodontal series
No. cases	34	33
Cases positive	28	29
Cases negative	6	4
Cases with 1 organism	13	7
Cases with multiple organisms	15	22
% positive	82	88

Table 4 • Groups of organisms and their distribution

Organism	Extraction series		Periodontal series	
	No. organisms	%	No. organisms	%
Streptococcus	18	38	18	36
Diphtheroid	13	28	16	32
Vibrio	1	2	1	2
Spirillum	2	4	2	4
Tetracoccus	3	6	4	8
Bacteroides	4	8	6	12
Veillonella	0	0	5	10
Fusobacterium	0	0	7	14
Actinomyces	3	6	7	14
Micrococcus	1	2	1	2
"*Leptotrichia*"	0	0	1	2
Nontypable anaerobes	2	4	2	4
Total	47		70	

isms from the peripheral blood was to be expected, therefore, especially since the media usually employed in blood culturing tend to favor their growth.

It seems probable that the recovery of such a wide variety of organisms as that herein reported is dependent, among other things, on the size of the blood sample, the dilution ratio of blood to medium, and the choice of media. Obviously, there is a wide range of possibilities for media. We chose, however, to test the possibilities of medium AS, which has been used highly successfully by Hampp in the primary isolation and continued cultivation of a great variety of fastidious microorganisms including spirochetes.[8] In a preliminary series of 20 patients this medium was compared with the routine medium and with blood samples obtained by the technics employed at the Clinical Center of the National Institutes of Health. It was found that this routine hospital technic yielded only 31 per cent positive samples from which 80 per cent of the isolates were streptococci. Similar data were reported by Penfold[12] whose media and technics were almost identical with those used in this hospital. Medium AS, on the other hand, yielded 75 per cent positive samples, 27 per cent of which contained streptococci. Also, 73 per cent of the samples from medium AS yielded organisms other than streptococci, none of which were found by the hospital procedure. The organisms were three strains of *Bacteroides,* one *Vibrio,* a gram-positive, motile, anaerobic, small rod, and anaerobic diphtheroids. These data support the contention that routinely used media and sampling technics favor the development of streptococci.

The relatively rapid growth of streptococci in suitable carbohydrate-containing media has been observed so commonly that it hardly requires discussion. During this rapid growth the streptococci may produce sufficient acidity to inhibit considerably or even prevent the growth of a number of the organisms already discussed. It seems also that the streptococci may withstand preferentially the relatively unfavorable balance of nutrients and inhibitors produced by low blood to medium dilution ratios. This is probably true also for saponin and

citrate.[12] Thus, the choice of medium AS, containing little carbohydrate, reduced by glutathione, and enriched with ascitic fluid from the dog, seems fortunate.

There has been an increasing interest in optimal blood culture technics and selection of media. For example, Penfold and co-workers[12] studied this problem, but unfortunately their patient samples were heavily biased for the recovery of streptococci and staphylococci because of the specific diseases studied. However, in this typical study no attention was focused on the amount of blood to be sampled or on the blood-to-medium ratio. The work of Beeson and co-workers[13] showed that when endocarditis ended fatally, the blood could contain as few streptococci as 25 per milliliter. The study by Okell and Elliott[11] of bacteremias after dental treatment also proved that the numbers of bacteria in the blood stream are low since 26 per cent of the plate counts were less than 1 per ml.; 56 per cent were from 1 to 5 per milliliter; 7 per cent were from 6 to 10 per milliliter; 4 per cent ranged from 11 to 15 per milliliter; and only 7 per cent were greater than 15 per milliliter. If this is the case, then the amount of sample to be taken is of great importance for the detection of microorganisms.

There is ample precedent for an understanding of the problem of sampling. The pioneer work of McCrady[14] and its application to water analysis led to the development of the "most probable number" concept, based on the size and number of aliquots sampled. The further theoretical development of the sampling problem by Halvorson and Ziegler[15] is now classic. From their work it can be seen that given 1 organism per 5 ml. sample, simply because of the vagaries of statistical distribution, independent of other factors, organisms could be recovered only 63 per cent of the time. If the sample size is 10 ml. the positive cases may be increased to 86 per cent. It is for this reason that in the present work we chose a sample size of 45 ml. distributed equally three ways, which should statistically assure a recovery frequency of 99.9 per cent.

Another important factor is the dilution ratio of blood to medium. It is well recognized that blood and certain other body fluids contain a variety of inhibiting substances active against many organisms.[16] Elliott[7] and Penfold and co-workers[12] have recognized this phenomenon in the case of streptococci by adding saponin to media for the purpose of lysing blood cells, thereby increasing significantly recoveries of streptococci from patients and in vitro studies. However, saponin has been shown[12] to be inhibitory to staphylococci and a variety of other organisms. Furthermore, the addition of materials like blood, particularly in relatively high concentrations, may not necessarily be beneficial for the growth of certain species. For instance, unpublished data gathered in this laboratory have shown that cysteine beyond certain minimal concentrations is inhibitory for *Veillonella* and that *p*-aminobenzoic acid is toxic for lactobacilli. It is interesting, therefore, to observe that Penfold and co-workers[12] often used a dilution ratio of blood to medium volume of only 1:3 and Okell and Elliott[11] a ratio of 1:5. The use of such low dilution ratios seems to be routine hospital practice. In the present work the dilution ratio has been 1:12.3 and it is not yet certain that this is adequate to dilute blood inhibitory substances and to establish optimal conditions for the growth of the small numbers of bacteria initially present.

SUMMARY

Postoperative bacteremias were found in 82 per cent of 34 patients requiring extractions and in 88 per cent of 33 periodontal patients after curettage, gingivectomy and other periodontal procedures. In 46 per cent of the group needing extractions in whom the findings were posi-

tive only 1 type of organism was found, whereas 2 or more different microorganisms were isolated simultaneously in 54 per cent of the samples. In the periodontal group 76 per cent of the patients yielded more than 1 organism.

Of 97 strains recovered from the combined extraction and periodontal groups, 37 per cent were streptococci and 33 per cent were diphtheroids (primarily anaerobic or microaerophilic). This ratio compares favorably with the distribution of isolates obtainable from oral sources. There was no difference in the incidence of these microorganisms in the two groups of patients.

In addition, 34 per cent of the isolates from the patients requiring extractions were less commonly encountered organisms, of which 2, 4, 8, 6 and 4 per cent were representatives of the genera *Vibrio, Spirillum, Bacteroides, Actinomyces,* and anaerobic small gram-positive motile rods, respectively. There were no *Veillonella* or *Fusobacterium* species. Samples from the periodontal patients yielded singly, or in combinations with other organisms, members of such genera as *Vibrio, Spirillum, Bacteroides, Veillonella, Fusobacterium, Actinomyces, "Leptotrichia,"* and anaerobic small gram-positive motile rods with frequencies of 2, 4, 12, 10, 14, 14, 2, and 4 per cent, respectively.

The recovery of a greater diversity of anaerobic and fastidious microorganisms than has been previously reported by others as well as the high incidence of bacteremias detected in this series may be attributed mainly to the use of (1) large (45 ml.) blood samples distributed in 15 ml. aliquots into 3 media; (2) a greater dilution of blood to medium (1:12.3) to reduce the inhibitory action of blood and to effect a more favorable balance of nutrients for microbial growth; (3) media capable of supporting the growth of small numbers of fastidious microorganisms under anaerobic conditions.

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Anticaries technics in nonfluoride areas: topical fluoride treatment

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Forty per cent of the population of the United States live in areas not served by community water supplies, and therefore are not in a position to receive an optimal amount of fluoride in their drinking water. It has been demonstrated that topical applications of a fluoride solution can bring about a substantial reduction of dental caries. Some studies have demonstrated stannous fluoride to be more effective than sodium fluoride. Technics for applying both solutions are described. More children can receive the benefits of topical applications of a fluoride solution if the treatment is planned on a community basis, enlisting the aid of mothers of students to assist the participating dentists.

The daily ingestion of an optimal amount of fluoride, particularly during the growing period of the permanent teeth, appears to be the most effective means of reducing dental caries. If, however, all the present community water supplies in the United States were to adjust their fluoride content to the recommended amount, only 60 per cent of the total population would be served.[1] Approximately 60 million people (40 per cent of the total population) must look elsewhere for a fluoride control program. The dental profession has been cognizant of this, and through dental research has presented other means of applying fluorides as a caries inhibitor. One means is the topical application of a fluoride solution to the erupted teeth. Various types of fluoride solutions have been tried in laboratory experiments and clinical studies. Some fluorides have shown promising results in laboratory tests but negative results when tried on the human teeth clinically. This article is devoted to the technics of the topical treatments for sodium fluoride and stannous fluoride.

SODIUM FLUORIDE

It has been demonstrated by Knutson and Armstrong,[2-4] Bibby,[5] Galagan,[6,7] Jordan[8] and others[9-11] that a 2 per cent solution of sodium fluoride applied topically to erupted teeth is capable of reducing dental caries by approximately 40 per cent (Table 1 and 2). These studies have determined that four applications of a 2 per cent solution are necessary to obtain maximum results. The procedure known as Knutson's technic[12] has been the accepted method.

Because it is desirable to protect the permanent teeth as soon as they erupt, the topical application of sodium fluoride

Table 1 • Studies of topical application of fluorides

Study	Patients treated	Teeth treated	Controls	Age	Prophylaxis	Solution	Number of applications	Years since first application	Per cent reduction
Bibby, B. G.[5]	90	One mouth quadrant	Untreated mouth quadrant	10–12	Yes	.1% NaF	3	1	45.8
	78	One mouth quadrant	Untreated mouth quadrant	10–12	Yes	.1% NaF	6	2	33.3
	39	One mouth quadrant	Untreated mouth quadrant	10–12	Yes	.1% NaF	6	5	36.0
Knutson, J. W., & Armstrong, W.D.[2,3]	289	One side of mouth	Untreated half of mouth	7–15	Yes	2% NaF	8–15	1	39.8
	270	One side of mouth	Untreated half of mouth	7–15	Yes	2% NaF	8–15	2	41.4
	242	One side of mouth	Untreated half of mouth	7–15	Yes	2% NaF	8–15	3	36.7
Jordan, W. A., & others[8]	241	One side of mouth	Untreated half of mouth	6–12	Yes	2% NaF	1	1	4.9
	575	One side of mouth	Untreated half of mouth	6–12	Yes	2% NaF	2	1	10.0
	161	One side of mouth	Untreated half of mouth	6–12	Yes	2% NaF	3	1	21.0

is recommended at the age levels of 7, 10, and 13 years. At the age of 7 years the first permanent molars are in place; at 10 the anterior teeth have erupted, and by the time the child is 13 all the permanent teeth have erupted except the third permanent molar. These ages have been recommended because of the average eruption pattern of the teeth. However, there are always variations of the average which the private practitioner can detect, and he can act accordingly. Jordan,[8] Wittich,[13] Cheyne[14] and Ast[15] have demonstrated that a 2 per cent sodium fluoride solution treatment also reduces dental caries in deciduous teeth and presents an opportune way of introducing the three year old child to dental technics and office procedures (Table 3).

Technic • The first step in the topical application of sodium fluoride consists of a thorough cleansing of the coronal surfaces of the teeth. A motor-driven rubber cup and fine pumice paste may be used. The teeth are cleaned in only the first of the four applications.

In the second step, the cleansed teeth are isolated with no. 2 cotton rolls held in place by Garmer cotton roll holders. Half of the teeth in the upper quadrant and the opposing lower quadrant are isolated at one time. Cutting the cotton roll ends at 30 to 45 degree angles helps to keep them in their proper place. A continuous cotton roll which covers the upper and lower quadrants can be used for the buccal surfaces. The cotton rolls should be placed to clear all crowns of

the teeth, allowing free application of solution.

After the teeth have been isolated with cotton rolls, they are dried with compressed air. From 15 to 20 pounds of pressure is used to facilitate adequate drying of the proximal surfaces.

The fourth step in the procedure consists of applying a 2 per cent solution of sodium fluoride to the clean, dried, enamel surfaces of the teeth. A loose cotton applicator saturated with the solution may be used. A definite procedure should be adopted in applying the solution to be sure all surfaces are treated. One saturated cotton swab will be sufficient for one quadrant. The upper quadrant having been treated first, the lower quadrant is treated next. The solution should be allowed to be in contact with the teeth for four minutes before the cotton rolls are removed. Rinsing the mouth after treatment is not essential to the procedure. The use of a saliva ejector, when possible, will aid in keeping excessive saliva away from contact with the tooth surface. A light spray is sometimes used in applying the solution. I, however, prefer the cotton swab.

The second, third and fourth applications can be separated by intervals of one day, one week, or two weeks. Full benefits will be obtained only after the four applications.

On a community basis, where specific age or grade groups in schools are treated,

Table 2 • Studies of topical application of fluorides

Study	Patients treated	Teeth treated	Controls	Age	Prophylaxis	Solution	Number of applications	Years since first application	Per cent reduction
Knutson, J. W.; Armstrong, W. D., & Feldman, F. M.[4]	472	One side of mouth	Untreated half of mouth	7–15	No	2% NaF	2	2	9.3
	504	One side of mouth	Untreated half of mouth	7–15	No	2% NaF	4	2	20.1
	482	One side of mouth	Untreated half of mouth	7–15	No	2% NaF	6	2	21.0
Galagan, D. J., & Knutson, J. W.[5]	301	One side of mouth	Untreated half of mouth	7–15	Yes	2% NaF	2	1	21.7
	247	One side of mouth	Untreated half of mouth	7–15	Yes	2% NaF	4	1	40.7
	259	One side of mouth	Untreated half of mouth	7–15	Yes	2% NaF	6	1	41.0
	272	One side of mouth	Untreated half of mouth	7–15	Yes	.06% PbF_2	2	1	5.9
	214	One side of mouth	Untreated half of mouth	7–15	Yes	.06% PbF_2	4	1	1.6
	262	One side of mouth	Untreated half of mouth	7–15	Yes	.06% PbF_2	6	1	0.8

Table 3 • Studies of topical application of fluorides

Study	Patients treated	Teeth treated	Controls	Age	Prophylaxis	Solution	Number of applications	Years since first application	Per cent reduction
Cheyne, V. D.[11]	27	All (decid.)	19	4½–6	Yes	.05% KF	2	.28	50
Jordan, W. A., and others[8]	241	One side of mouth (decid.)	Untreated half of mouth	6–12	Yes	2% NaF	1	1	4.9
	575	One side of mouth (decid.)	Untreated half of mouth	6–12	Yes	2% NaF	2	1	14.5
	161	One side of mouth (decid.)	Untreated half of mouth	6–12	Yes	2% NaF	3	1	40.0
Arnold, F. A., Dean, H. T., & Singleton, D. E., Jr.[9]	94	All	94	16–23	Yes	1.5% NaF	1	1	0
East, B. R., & others[10]	48	One per child	Like tooth	Unknown	No	.05% KF	1–4	1	0
McCauley, H. R., & Dale, P. P.[11]	21	One side of mouth	Untreated half of mouth	2–13	No	.1% NaF	3–11	1	Bilateral
	21	One side of mouth	Untreated half of mouth	2–13	No	.1% NaF	3–11	2	0

a multiple chair technic is used to advantage.

Formula for 2 Per Cent Solution of Sodium Fluoride • Eight ounces of distilled water are added to 4.8 Gm. of sodium fluoride compound, to obtain a 2 per cent solution. Analytical reagent grade, chemically pure sodium fluoride, should be used. This runs about 99 per cent pure.

STANNOUS FLUORIDE

Gish,[16,17] Howell,[18] Muhler[19-21] and others have demonstrated a stannous fluoride solution to be superior to sodium fluoride as a caries inhibitor (Table 4). Howell[18] conducted a study on the effects of four applications of 2 per cent stannous fluoride solution to the teeth of a group of children, ages 6 to 15 years, and four applications of a 2 per cent solution of sodium fluoride to another group also ranging in age from 6 to 15 years. A control group in the same age bracket was maintained. The findings showed the 2 per cent stannous fluoride to be superior to the 2 per cent sodium fluoride. The sodium fluoride group showed a 23.6 per cent reduction when compared to the control group. The group treated with stannous fluoride solution had an 83 per cent reduction.

Gish[16] recently conducted a study comparing a single annual application of an 8 per cent stannous fluoride solution to four applications of a 2 per cent sodium

fluoride solution applied once every three years (Table 5). At the end of the first year of the study the single 8 per cent stannous fluoride solution was 21 per cent more effective than the four applications of a 2 per cent sodium fluoride solution. At the end of the second year the difference was 32 per cent in favor of stannous fluoride. At the end of three years the study showed the single, annual 8 per cent stannous fluoride treatment to be 35 per cent better than four applications of a 2 per cent sodium fluoride solution applied every three years.[17]

In another study Nevitt, Witter and Bowman[22] compared the results of the application of a 2 per cent sodium fluoride solution to the application of a 2 per cent stannous fluoride solution (Table 6). The teeth of more than 600 children in age groups 9 to 14 years in Milwaukee and Oregon City, Ore., were examined. The group was divided into two comparable groups for treatment. One group received the sodium fluoride solution on one side of the mouth and distilled water on the other. The second group received stannous fluoride solution on one side and distilled water on the other. Celluloid strips were used between the central incisors to prevent the solution from contacting the control side.

The results show a 44.4 per cent reduction in the caries rate for the group treated with stannous fluoride and a 35.9 per cent reduction in the caries rate for the group treated with sodium fluoride. The examinations were made in December 1955; treatment started in January 1956 and was completed in four months. Each child received four applications of either the sodium fluoride or the stannous fluoride.

Jordan, Snyder and Wilson[23] conducted a two-year study at Rochester, Minn.; one application of 8 per cent

Table 4 • Summary of caries findings after two years in children receiving topical application of stannous fluoride or sodium fluoride*

Average caries increment per person for two year period

Group	Subjects	Aver. DMF teeth	Average DMF surfaces					
			In prev. caries-free teeth	In prev. DF teeth	Proximal surfaces	Occlusal surfaces	Bucc. & lingual surfaces	Total DMF surfaces
Control	139	2.84	3.83	.69	2.19	2.24	.09	4.52
A†	92	2.17	2.38	.50	1.70	.98	.21	2.88
B‡	194	0.48	1.84	.02	1.59	.38	−.11	1.86
C§	195	1.11	1.99	−.43‖	1.31	.44	−.19	1.56

Percentage difference or reduction in increase of new caries compared to those of control group

Group	DMF teeth	In prev. caries-free teeth	In prev. DF teeth	Proximal surfaces	Occlusal surfaces	Total DMF surfaces
A	23.6	37.9	27.5	22.4	56.2	36.3
B	83.1	52.0	97.1	27.4	83.0	58.8
C	60.9	48.0	100.0	40.2	80.4	65.5

*Howell, C. L., and others. Effect of topically applied stannous fluoride on dental caries experience in children. J.A.D.A. 50:14 Jan. 1955.

†Sodium fluoride by cotton applicator.

‡Stannous fluoride by cotton applicator.

§Stannous fluoride by spray, continuously applied.

‖This negative number was taken as zero for computation of percentage reduction.

stannous fluoride solution was made each year on children 12 to 15 years old. A control group in the same area was maintained. At the end of the first year a 20 per cent reduction in caries rate was obtained (Tables 7 and 8). After a single application annually for two years, the experimental group had a caries rate 38 per cent lower than the rate for the control group.[24]

Muhler[25] has conducted a study in which he applied a 10 per cent stannous fluoride solution topically to permanent teeth of adults and obtained a 24 per cent reduction in DMF teeth increment in one year.

There has been some question as to the value of a topical fluoride treatment in areas where an optimal amount of fluoride is present in the drinking water. Downs and Pelton[26] saw no caries reduction after standard treatment with a 2 per cent sodium fluoride solution in two groups of children whose community water contained 0.4 and 1.0 ppm of natural fluoride, respectively.

Galagan[27] studied the effect of topical fluorides on the teeth of 350 children 7 to 16 years of age, who had matured in an area containing an optimal amount of natural fluorides in the water. A series of topical applications of a 2 per cent solution of sodium fluoride resulted in a 9 per cent reduction in the dental caries incidence.

Muhler[25] is conducting a five-year study in Indianapolis, where the fluoride content of the drinking water has been supplemented to 1 ppm. That city had been fluoridating the drinking water for six years when this study was started. A total of 600 children, divided into two comparable groups, were studed. Group one received a single application of an 8 per cent stannous fluoride solution every six months. Group two received a single application of distilled water every six months. At the end of the first year the treated group showed 35 per cent fewer DMF teeth than the control group, and 28 per cent fewer DMF surfaces.

According to McDonald[28] a 4 per cent stannous fluoride solution applied topically is superior to the 2 per cent solution of sodium fluoride in reducing caries in the deciduous teeth (Table 9). Three groups of children were used in the experiment. Group one received four ap-

Table 5 • Comparison at end of three years of effectiveness of a single application per year of 8 per cent solution of stannous fluoride to a series of four applications of sodium fluoride once every three years*

Group	Time of examination	Agent	No. of subjects	DMF teeth		DMF Surfaces	
				Increment	% Reduction	Increment	% Reduction
I	1 year	NaF	242	0.76	21 (p = .08) †	1.25	26 (p = .025)
		SnF_2	247	0.60		0.93	
	2 year	NaF	222	1.08	32 (p = .004)	1.94	21 (p = .04)
		SnF_2	226	0.73		1.53	
	3 year	NaF	220	1.48	35 (p = .001)	2.68	35 (p = .002)
		SnF_2	196	0.96		1.73	
II	1 year	NaF	237	0.58	59 (p = .0007)	1.19	56 (p = .0002)
		SnF_2	230	0.24		0.52	
	2 year	NaF	235	0.98	46 (p = .001)	1.88	57 (p = .0001)
		SnF_2	222	0.53		0.81	
III	1 year	NaF	226	0.84	31 (p = .001)	1.33	35 (p = .001)
		SnF_2	224	0.58		0.86	

*Gish, C. W.; Muhler, J. C., and Howell, C. L. Stannous fluoride vs. sodium fluoride--a progress report. J. Den. Children 25:177, 3rd quart. 1958.

†Calculated on the basis of the T test.

Table 6 • Percentage of fewer newly carious teeth and tooth surfaces in permanent teeth of fluoride-treated mouth quadrants of 588 children, in Milwaukee and Oregon City, Oregon, during 16 month period*

Fluoride solution	Percentage fewer newly carious teeth			Percentage fewer newly carious surfaces of previously carious teeth		
	Upper arch	Lower arch	Both arches	Upper arch	Lower arch	Both arches
Stannous fluoride	46.3	41.3	44.4	9.1	11.8	10.4
Sodium fluoride	33.5	40.6	35.9	5.4	15.5	10.3

*Nevitt, G. A.; Witter, D. H., and Bowman, W. D. Topical applications of sodium fluoride and stannous fluoride. Pub. Health Rep. 73:847 Sept. 1958.

Table 7 • Incidence of caries at the end of one year, after a single application of 8 per cent stannous fluoride solution to erupted permanent teeth of children 12-13 years old in Rochester, Minn.*

Location of new caries	Control group (N = 238) †	Experimental group (N = 234)	Difference between groups	Reduction in per cent	P
Teeth	2.15 ± 0.112	1.72 ± 0.108	0.43	20.0	.0052
Surfaces	4.79 ± 0.229	4.10 ± 0.221	0.69	14.41	.0308

*Jordan, W. A.; Snyder, J. R., and Wilson, V. O. The Olmsted County, Minnesota stannous fluoride clinical study: First year report to determine value of single application of an eight per cent stannous fluoride solution as a caries inhibitor to permanent teeth.

†Some teeth thought to be carious when first examined were subsequently found to be noncarious. The incidence of reversed diagnosis was 0.265 for the control group and 0.360 for the experimental group.

plications of a 4 per cent stannous fluoride solution; Group two received four applications of a 2 per cent sodium fluoride solution, and Group three was used as a control. The group treated with stannous fluoride showed a 57 per cent reduction in the def tooth rate as compared to the control, and the group treated with the sodium fluoride revealed a 21 per cent reduction in caries rate of the deciduous teeth.

The trend of the studies of a single application of an 8 per cent stannous fluoride solution points to a valuable preventive health measure. The private practitioner will be more interested in providing such preventive services when application is simple and not time consuming. On this basis the single application treatment for stannous fluoride should appeal to him. From one source of supply of stannous fluoride there is some evidence of the interest of the dentist in use of this solution. About 10 per cent of American dentists and 25 per cent of Canadian dentists have made requests within the last year for this material and its use.

Single Application Technic of Stannous Fluoride • In order to obtain the maximum benefit from stannous fluoride, the following precautions[39] should be strictly observed. At the first treatment a prophylaxis is performed. Each tooth surface is thoroughly cleaned and polished by aid of pumice. Sandpaper strips are used to polish interproximal surfaces. Toothbrushing, as a substitute for the prophylaxis, is not satisfactory.

Immediately after the prophylaxis, the teeth to be treated are isolated by no. 2 cotton rolls. A quadrant or a half of the mouth can be treated at a time. Cotton

Table 8 • Effect of a single topical application of a 10 per cent unbuffered aqueous solution of stannous fluoride on caries reduction in adults after one year*

	Group		Caries rate reduction (%)
	Control	SnF_2	
Number of subjects	207	228	
DMFT increment	0.95	0.72	24 (p = .04) †
DMFS increment	2.98	2.50	16 (p = .08)
Proximal surfaces	2.03	1.50	26
Occlusal surfaces	0.64	0.57	11
Buccolingual surfaces	0.31	0.42	−35

*Jordan, W. A.; Snyder, J. R., and Wilson, V. O. The Olmsted County, Minnesota stannous fluoride clinical study: First year report to determine value of single application of an eight per cent stannous fluoride solution as a caries inhibitor to permanent teeth.

†Probability based upon the T test.

roll holders are used to hold the rolls in place. Every effort should be made to keep the teeth free from saliva.

The isolated teeth are thoroughly dried with compressed air. The stannous fluoride is then applied to the clean, dry teeth with a cotton swab, keeping the teeth moist with the stannous fluoride solution for four minutes by repeatedly moistening the teeth with the fluoride solution. A timer can be used to assure the proper time of application. The same procedure is followed on the other half of the mouth until all teeth are treated. The patient is dismissed after being cautioned not to eat or drink (or rinse his mouth) for at least 30 minutes.

It is suggested that this treatment be given annually or each time the patient receives a prophylaxis. In some instances this might be two or three times a year. If the child is highly susceptible to caries, more than one annual application of an 8 per cent stannous fluoride solution should be applied. A complete treatment of a single application of an 8 per cent stannous fluoride solution and a prophylaxis requires about 30 minutes.

Preparation of Stannous Flouride Solution • The clinical effectiveness of stannous fluoride depends on the maintenance of the stannous tin in an active state. To insure that the solution of stannous fluoride has a maximum percentage of stannous tin in an active form, the solution must be prepared fresh for each treatment and used immediately. This is most conveniently accomplished by having a pharmacist weigh 0.80 Gm. portions of solid stannous fluoride into Lilly no. 0 gelatin capsules. It is important to keep the filled capsules containing the solid stannous fluoride in a container which can be sealed tightly after the removal of individual capsules. Similarly, the solid sample of stannous fluoride should be sealed tightly against air and moisture before it is dispensed into individual capsules. These precautions will aid in preventing oxidation and hydrolysis of the surface crystals.

Immediately before use, the contents of a single capsule are added to 10 ml. of distilled water and shaken briefly. The solution is mixed conveniently by stirring it with the cotton-free end of the wooden cotton applicators which will be used to apply the solution to the teeth. Immediately after the entire contents have completely dissolved, the solution is applied to the teeth. The 10 ml. of solution should suffice to treat the entire mouth of a single patient. If any solution remains it should be discarded and not used later. The preparation of the solution can be accomplished by the assistant while the dentist or dental hygienist is about to complete the prophylaxis.

No flavoring or coloring agent should be added to the stannous fluoride solution. Attempts to "mask" the unpleasant taste have decreased the anticariogenic effectiveness of the solution by decreasing the availability of the stannous ion. The use of high concentrations of any heavy metal, such as the tin portion of this solution, is associated with an unpleasant astringent taste. Almost all of the unpleasant consequences of this effect can be entirely eliminated, or minimized, by preparing the child properly before

Table 9 • Mean caries increment in deciduous teeth of children receiving a series of topical applications of either sodium fluoride or stannous fluoride during a one-year study period.*

Group	Subjects	Mean total new DMF teeth	Per cent reduction	Mean total new DMF surfaces (on previously sound and carious teeth)	Per cent reduction
Stannous fluoride	86	0.33	57	1.79	37
Sodium fluoride	76	0.61	21	2.50	12
Control	65	0.77	—	2.84	—

*McDonald, R. E., and Muhler, J. C. Superiority of topical application of stannous fluoride on primary teeth. J. Den. Children 24:84, 2nd quart. 1957.

the topical application. If he is informed in advance in an honest manner of the unpleasant taste, usually this will do much toward eliminating this problem.

The topical application of stannous fluoride frequently elicits a copious flow of large volumes of saliva, which often is great enough to interfere with isolation of teeth during the fluoride treatment. Many dentists have reported that 50 mg. of methantheline bromide, given orally 30 minutes prior to the topical treatment, greatly reduces saliva flow.

Pigmentation of Teeth After Stannous Fluoride Application • There has been some concern by a few dentists regarding the pigmentation of the teeth after the application of a highly concentrated solution of stannous fluoride. Pigmentation of the teeth definitely occurs after the use of concentrated stannous fluoride solutions, if a pre-carious or carious lesion is present. Pigmentation is considered highly beneficial and is interpreted by the researchers as an extremely useful result of the fluoride treatment. Observations have shown that no tooth surface will be pigmented that does not have a pre-carious lesion.[30] There is definite evidence that only the frank carious lesion becomes pigmented, and that noncarious surfaces show no color change (Table 10).

Massler[31] reported that a saturated (0.9 per cent) sodium silicofluoride solution was a great deal more effective than sodium fluoride in making tooth enamel resistant to acids in vitro. In a clinical study by Peterson and Jordan[32] however, the results were negative. Lead fluoride in laboratory tests proved valuable, but on clinical applications the results were also negative. At present, sodium fluoride and stannous fluoride have been demonstrated by clinical studies to reduce tooth decay. Laboratory studies suggest that this effect may be a result of the reduction in acid solubility of enamel that has been treated with these salts. The mechanism has not been clearly elucidated, however.

FLUORIDE TREATMENT IN THE COMMUNITY

In those communities and rural areas that do not have the advantages of the recommended fluoride content in their drinking water, it is suggested that the topical fluoride treatment be planned on a community basis. Such a program has been adopted in several states, including Minnesota, with considerable success. It becomes a locally sponsored program through the joint efforts of the dentists and, generally, the parent-teacher association. On request, the Section of Dental Health of the Minnesota Department of Health assists the local community on a demonstration basis for about three years.

Table 10 • Comparison between the oral hygiene, the pigmentation index and the dental caries increment in subjects receiving topical applications of stannous fluoride or stannous chlorofluoride*

Series	Treatment group	F conc. %	No. of subjects	Duration of study applications (months)	No. applications	Mean oral hygiene	Mean pigmentation index	Caries increment	
								Teeth	Surfaces
I	SnF_2	10	37	12	2†	1.54	0.55	0.62	2.16
	H_2O	—	37		2	1.75	0.60	1.03	2.56
						% reduction		39	15
II	SnF_2	8	45	3	1	2.17	0.51	0.33	0.69
	H_2O	—	47		1	2.14	0.29	0.60	1.32
						% reduction		45	48
III	SnClF	4	101	12	4	2.22	0.80	0.97	2.35
	H_2O	—	107		4	2.00	0.68	1.70	3.70
						% reduction		43	37

*Muhler, J. C. Effect on gingiva and occurrence of pigmentation on teeth following the topical application of stannous fluoride or stannous chlorofluoride. J. Periodont. 28:281 Oct. 1957.
†Spaced six months apart.

The Section of Dental Health meets with a representative committee of the local dentists, school officials and parents and outlines the procedures of the treatment program on a community basis. Favorable dates are agreed on by all, particularly the schools, since these treatments are given in the various school buildings with the use of portable equipment. The portable equipment is supplied by the Section of Dental Health. Staff members of the Section of Dental Health set up a schedule according to the number of children eligible for the program and schedule the dentist's time to the program. The president of the local dental group obtains the names of all dentists who wish to participate in the program. Each dentist is given a schedule at least two months before the program begins so he can adjust his office appointments.

A multiple chair technic is used in the community treatment program, by placing four straight-backed chairs in a row on risers about a foot high. These risers are used so that the dentist will not bend his back any more than necessary. The risers should be about 12 inches high, 30 inches wide and long enough to provide adequate space for the four chairs and for the students. Two four-foot lengths work out well. The community should supply this item and keep it on hand for each year's use.

A long table is placed conveniently with all necessary items arranged so that dentists can avoid unnecessary movements. A lay person or one of the mothers assists the dentist by cutting cotton rolls, sterilizing instruments, preparing cotton swabs and performing other similar tasks.

In accordance with the interpretation of the state dental law, some states such as Minnesota require that the dentist is the only one allowed to apply the fluoride solution. I think that it takes much valuable time which the dentist could apply to more technical procedures. Where not prohibited by law, the topical fluoride or any other similar preventive treatment could be applied by a trained dental hygienist. This is one field in which auxiliary aids can be used to advantage.

Arrangements have been made in

Minnesota with the School of Dentistry of the University of Minnesota, whereby senior dental hygiene students are assigned to community projects to assist local dentists in the cleaning of teeth. Although the students do not receive any remuneration for this service, they gain the experience of working on a health project and the possibility of getting an opportunity to demonstrate some dental health feature to students in the classroom. The local community is responsible for meals and rooms for these students. The Section of Dental Health is responsible for their transportation to and from the project and the supervision of their activities while on the program.

Each group participating in these programs has its specific responsibilities and duties. The dentist agrees to participate and give the treatment. He agrees with the local sponsoring group on the fee to be charged. In Minnesota the office fee for such services varies from $10.00 to $20.00. On the community basis where four treatments are conducted within the same time as one treatment in the private office, dentists have accepted the fee of $4.00 for the completed treatment.

The sponsoring organization, such as the parent-teacher association, is responsible for collection of fees, paying for dispensable supplies, rooms and meals for student hygienists and distribution of the balance of the money among the participating dentists according to time rendered.

This group also must arrange for lay assistants. Two mothers are required for each unit, to act as clerk and assistant. The group also arranges transportation to treatment centers when necessary.

When the program is conducted on a community basis and when the schools are involved, the program will adapt itself to the governing policies of the school. In this case a grade level is recommended in preference to age levels. Grades 2, 5 and 8 are comparable to the ages 7, 10 and 13 years. Each year the students in these grades would be eligible for the fluoride treatment program. This type of program can be conducted on a county basis and set up to bring in the rural schools. The three-year-olds in the community can be invited.

The dentists of each community should establish a base line survey to evaluate any future dental health program. This is a responsibility of the local dentist to his community. Not only must the people be informed of the best dental health practices, but they also want to see the results of these practices. Without a means of evaluation this cannot be done.

SUMMARY

Various studies have demonstrated that sodium fluoride and stannous fluoride solutions have the ability to reduce the dental caries rate when applied topically to the erupted deciduous and permanent teeth of children.

Some studies have demonstrated stannous fluoride to be more effective than sodium fluoride. Stannous fluoride must be used in a fresh state and is not stable. The preparation of a fresh stannous fluoride solution is simple. Sodium fluoride has a much longer shelf life in solution.

The single application of an 8 per cent stannous fluoride solution annually will no doubt be more appealing to the private practitioner than the four applications of sodium fluoride every three years.

The adoption of the topical fluoride treatment on a community basis will make it possible to extend more services to more children in a given time. Such programs can make use of auxiliary aids. Either sodium or stannous fluoride solutions can be used. There are some indications that the topical applications of stannous fluoride solution might aid in reducing dental caries even in a fluoridated area. In providing the child patient with the best services for good dental health in a nonfluoridated area, the

treatment plan should include the topical fluoride application as a preventive measure, in conjunction with proper instructions for good mouth hygiene and information on ways of controlling excessive intake of sweets, as well as the best in dental care.

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Progress • The acquisition and systematization of positive knowledge is the only human activity which is truly cumulative and progressive. *George Sarton, Introduction to the History of Science, vol. I, p. 4.*

Phosphates and dental caries
I. Effect of metaphosphoric acid in the diet of weanling hamsters on dental caries development

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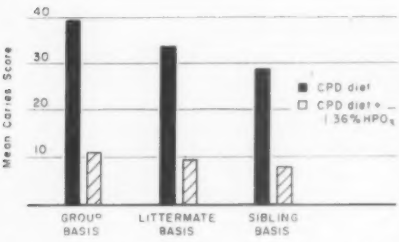
A group of weanling hamsters derived from caries-susceptible parents was maintained for 42 days on a cariogenic diet. A comparable group of hamsters was maintained on a similar diet except that it contained 1.36 per cent metaphosphoric acid at the expense of the sugar component. The group receiving the diet with phosphate developed a 70 per cent lower caries score than the control. The difference was statistically significant ($P = .0015$). It is not evident whether the cariostatic effect of metaphosphoric acid is local or systemic. Practical applications may be found for phosphates in the development of caries-resistant teeth.

As the result of a series of experiments with hamsters conducted in this laboratory during the past ten years,[1-6] it has become evident that the level of phosphorus in the diet is important in the prevention of dental decay.

First, it was found that the caries-producing activity of a diet composed of natural foodstuffs was reduced by 60 per cent by the addition of equivalent amounts of its ash (550°C.).[3,4] To determine which of the inorganic factors was responsible for this caries-inhibitory effect, a replicate of this ash was prepared using a mixture of pure salts of 11 elements, compounded in the proportions found by spectrographic and chemical analysis. The addition of this synthetic mineral mixture caused a 90 per cent reduction in the caries-producing activity of the diet when fed to hamsters.[5]

When phosphorus was omitted from three variations of this salt mixture in which different combinations of these elements were used, the caries activity exceeded that of the caries-producing control diet. The calcium:phosphorus ratio was not responsible for these variations in caries activity, for diets with the same calcium:phosphorus ratios differed in their cariogenicity, whereas diets with different calcium:phosphorus ratios were approximately equal in cariogenicity. It was apparent from this experiment, and proved in a subsequent one,[6] that the doubling of the phosphorus content of the control diet was the prime factor in causing the reduction in caries activity.

These earlier experiments were conducted with a diet which produced moderate caries in stock hamsters. In the research reported here, a diet which permits the development of rampant caries was used in feeding hamsters derived from caries-susceptible parents, thus permitting a more rigorous experiment. Previously, potassium dihydrogen phosphate (KH_2PO_4) had been used as the source of phosphorus in the salt supplement.[5] The current experiment was de-



Caries scores of hamsters after 42 days on diets

signed to determine the effects of the simplest phosphate, metaphosphoric acid, when fed it was as a supplement to a caries-producing diet. Metaphosphoric acid is soluble in water, is relatively nontoxic and nonirritating. It should be pointed out that metaphosphoric acid, otherwise known as vitreous sodium acid metaphosphate, contains as a "preservative," sodium metaphosphate, as well as sodium monoxide, in addition to the water and phosphorus pentoxide.[7]

PROCEDURE

Six male and nine female hamsters were placed on a caries-producing diet for 42 days, then transferred to a 1:1 mixture of Purina Lab Chow and National Institutes of Health Special Rabbit-Guinea Pig Ration, as suggested by Keyes.[8] After 21 days they were given pentobarbital sodium anesthesia, and examined under a stereoscopic microscope (27x) to determine the extent of caries development. Those which showed three or more carious molars were selected as breeding stock. Twenty eight males and 23 females from the resulting 14 litters produced in the F_1 and F_2 generations were used in the experiment.

The caries-producing diet fed to the control group of 14 males and 11 females was composed of confectionery sugar 59; nonfat milk powder 27; whole wheat 5; alfalfa 3; liver powder (1:20) 2; brewer's yeast 2 and Wesson salts (modified by omission of fluorine) 2. The diet of the test group fed to 14 males and 12 females was identical to that of the control group except that it contained 1.36 Gm. of metaphosphoric acid per 100 Gm. of diet, added at the expense of the sugar component. Each hamster was individually housed in a metal cage with a raised wire-mesh floor in an air-conditioned (75°F., 50 per cent relative humidity) laboratory. Distilled water and diets were supplied ad libitum to both groups.

After the animals had been on the respective diets for 42 days, their teeth were cleaned of debris by transferring both groups of hamsters to the Keyes ration[8] for 21 days. The hamsters then were killed. The jaws were cleaned of soft tissue, and the molars were scored in terms of the incidence and extent of carious lesions according to the Johannsen[9] modification of the Keyes[10] procedure.

RESULTS AND DISCUSSION

The total caries scores of the control and metaphosphoric acid-supplemented groups were recorded in terms of groups, littermates and siblings. The average scores of the control and metaphosphoric acid-supplemented groups were, respectively, 39.4 and 10.6 on a group basis, 32.4 and 9.1 on a littermate basis, and 28.1 and 7.8 on a sibling basis (see illustration).

In all three comparisons, the lower caries scores in the group fed the phosphorus supplement were statistically significant, and the amount of this difference was over 70 per cent.

The significance of differences between control and experimental groups was estimated by the simplest nonparametric test. These scores did not seem to be distributed in a simple way. Therefore, in the mathematical model used it was assumed that the probability of the score of any one of the controls being greater than the score of any one of the experimentals is one-half, a priori. When the

score of the control animal was greater than that of the experimental animal, a plus (+) sign was used; when the score of the control animal was less than that of the experimental animal, a minus (—) sign was used. The positive and negative signs should be binomially distributed.

To determine whether these results could have arisen by chance, the scores within the litters of the control and test groups were given the severest unbiased test, by comparing the individual scores in reverse order of magnitude, putting the highest experimental against the lowest control. The P value (the probability of arising by chance) was calculated from the number of positive and negative differences. The same nonparametric test was used for littermate and sibling scores. The P value was equal to .0015, .002 and .016 on the group, littermate and sibling bases, respectively. This means that the probability of chance giving rise to these results was so small that it can be stated with great assurance that the two populations from which the samples were taken were significantly different.

It is logical to inquire whether this cariostatic effect of the phosphate supplement is produced by local or systemic influences. Third molars may be expected to be more sensitive to systemic influences than the first and second molars, if experimental diets are offered to weanling (21 days old) hamsters. At this age the first and second molars are fully developed and the third molars are still immature.

The incidence of caries in the groups fed the caries-producing diet averaged 48, 83 and 99 per cent in the first, second and third molars, respectively, indicating that the less mature molars were more susceptible to the initiation of decay than the more mature molars. In 25 hamsters fed the caries-producing diet, 48 first molars were affected by caries; in the 26 hamsters fed the caries-producing diet to which was added metaphosphoric acid, 32 first molars became carious. Likewise, 83 second molars of the group fed the caries-producing diet became carious, whereas 56 second molars of those fed the same diet with the addition of metaphosphoric acid became carious. The group fed the caries-producing diet developed 99 carious third molars, and those fed the same diet with the addition of metaphosphoric acid developed 53 carious third molars. The "t" value and the level of significance of these figures are as follows: for the first molar, "t" value, 6.0 and level of significance, 0.1 per cent; for the second molar, "t" value, 13.0 and level of significance, 2.8 per cent; for the third molar, "t" value, 21.3 and level of significance, 0.1 per cent. The net decrease in caries incidence resulting from diet treatment was 35 per cent, 35 per cent and 49 per cent in the first, second and third molars, respectively. Since the reduction was greater in the third molars than in the others, it might appear that the cariostatic influence attributed to the metaphosphoric acid resulted, at least in part, from systemic effect. However, it should be remembered that studies[11] with radioisotopes have shown that mineral elements are absorbed readily from the saliva through the enamel and dentin and into the blood circulation. Furthermore, the immature tooth is about 10 to 20 times more active in this respect than the normal adult tooth. It is significant that the molars with the highest caries susceptibility showed the greatest decrease in decay, attesting to the great effectiveness of metaphosphoric acid as a cariostatic agent.

Several investigators[12, 13] have reported a direct correlation between the incidence of dental caries and the calcium:phosphorus ratios of the diets of their subjects. It was noted[14] that a high calcium:phosphorus ratio diet produced a tooth high in carbonate, which was more caries-susceptible.

Other investigators[15] have reported positive correlations between elevated

serum phosphorus levels and increased caries resistance. Saccharides in the diet during the suckling period caused a reduction in inorganic phosphate in the serum, and an increase in caries susceptibility.[16]

The preponderance of animal studies have dealt with the effects of different types of phosphorus compounds on the development of dental caries. Favorable results have been reported from the use of 1 per cent sodium biphosphate,[17] 5 per cent trisodium orthophosphate,[18] 1.1 per cent potassium acid phosphate,[5] 0.6 per cent[19] and 2.0 per cent[20] disodium orthophosphate, or 2 per cent secondary calcium phosphate[18,21] as supplements to cariogenic diets.

It appears from the literature that phosphorus compounds vary in cariostatic activity. For instance, Barnard and Johannsen[21] reported that 2 per cent calcium hydrogen phosphate had limited effectiveness when fed in a nutritionally adequate diet, but was ineffective in an inadequate diet. McClure and Muller[22] found that the effectiveness of calcium hydrogen phosphate was increased in the presence of sodium chloride.

It is to be expected that various investigators will find differences in the effectiveness of the various compounds because of variations in experimental design, differences in the solubility and permeability of the phosphates used, interference of absorption by other elements and compounds, and so forth.

In vitro experiments with organic phosphates, carried out originally by Osborn[23] and later by Jenkins,[24] suggest that the organic phosphates (primarily phytate) present in unrefined carbohydrate foods are responsible for the low cariogenic activity of these foods.

In a recent editorial review,[25] it was pointed out that the results obtained by McClure with 2 per cent sodium phosphate may have depended on a dietary deficiency of lysine. This could not have been true in the experiments reported here, for the proteins in the diet were of high nutritional quality, and were not deficient in lysine.

It is conceivable that practical applications will be found for phosphates in the development of caries-resistant teeth.

SUMMARY

A group of weanling hamsters derived from caries-susceptible parents was maintained for 42 days on a diet which produces rampant caries. A comparable group of hamsters was maintained on a similar diet, but which contained 1.36 per cent metaphosphoric acid.

The group receiving the diet with phosphate developed a 70 per cent lower caries score than the control. This difference was significant ($P = .0015$).

It is significant that the immature third molars were most caries-susceptible of the molars when hamsters were fed the caries-producing diet, and the most caries-resistant when hamsters were fed the phosphate-supplemented diet.

It is not yet evident whether this cariostatic effect of metaphosphoric acid is local or systemic.

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Temporomandibular joint criteria in dentoprosthetic rehabilitation

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Temporomandibular joint roentgenography supplies a guide to normal intermaxillary relationships and provides the best basis for obtaining harmonious dental occlusion. A new instrument has been developed which simplifies temporomandibular joint roentgenography, provides maximum definition with minimum exposure, and minimizes radiation to the patient and operator. In 70 patients, dental occlusal-temporomandibular joint difficulties caused joint and ear symptoms and diseases; these were alleviated by dentoprosthetic rehabilitation guided by criteria based on temporomandibular joint roentgenography.

Dentoprosthetic rehabilitation may be defined as the reconstruction and replacement of teeth in order to restore the masticating mechanism to its former condition or to an improved one. It consists of achieving a dental occlusion which establishes normal intermaxillary and temporomandibular relationships; one that articulates in harmony with the normalized temporomandibular joints.

Patients who need dentoprosthetic rehabilitation present deteriorated masticating mechanisms which have resulted from the gradual attrition, loss, displacement, and inadequate restoration and replacement of teeth. Retrogression of dental occlusion usually is associated with

occlusal disharmonies and overclosed bites that result in traumatic, abnormal intermaxillary and temporomandibular relationships. The temporomandibular joint abnormalities include traumatic displacement and movements of the condyles, deformity of the condyles, fossae and articular eminences, and traumatic malrelationships between the joints and the ears.[1-3] These abnormalities may cause mandibular joint pain and dysfunctions, neuralgias, symptoms and dysfunctions of the ear, including vertigo, tinnitus and deafness.[4,5]

Holistically, dentoprosthetic rehabilitation treats an abnormal condition which may cause or aggravate dysfunctions and symptoms of serious consequence to the patient's health, comfort and appearance. Since the operator has no available method of determining the former condition of the deteriorated masticating mechanism, the only professionally acceptable objective of dentoprosthetic rehabilitation is to restore the masticating mechanism in accordance with the scientific criteria of normality.

The scientific criteria of normality which define and guide the objectives of dentoprosthetic rehabilitation are those of prosthodontics and orthodontics, all of which involve temporomandibular relationships and movements. This article is concerned with the criteria of normality of temporomandibular joints and their application to dentoprosthetic rehabilitation:

1. Diagnosis of pathologic conditions in the joint and abnormalities associated with deteriorated and abnormal dental occlusions as a basis for prescribing dentoprosthetic rehabilitation.

2. Guidance of the indicated intermaxillary relationships in rehabilitation.

3. Provision of a basis for a dental occlusion that is in harmony with the temporomandibular joints.

4. Treatment and prevention of joint and ear symptoms and dysfunctions.

Previous articles have defined the anatomic and roentgenographic criteria of normal temporomandibular form and relation and have shown that the joints undergo retrogressive alterations associated with deterioration of the dental occlusion. These articles also have shown that the condition of the joint improves after dentoprosthetic rehabilitation which establishes normal intermaxillary and temporomandibular joint relationships and a harmonious dental occlusion; in addition, such rehabilitation effectively corrects certain symptoms and dysfunctions of the joints and ears. The purpose of this article is to show that temporomandibular joint roentgenography is the principal, practical method by which to determine normality of temporomandibular relationships, that it furnishes a guide to normal intermaxillary relationships and provides the best basis for obtaining harmonious dental occlusion.

TEMPOROMANDIBULAR JOINT ROENTGENOGRAPHY

A technic was developed and certain diagnoses based on lateral temporomandibular joint roentgenography were standardized (Fig. 1). These views show variations of the lateral outline and interrelations of the condyle, articular eminence, fossa and auditory meatus that are associated with normality or abnormal dental occlusion.

Dissections of the joint-ear regions of normal and abnormal masticating mechanisms (Fig. 2, 3) show the normal and abnormal anatomy which can be seen in lateral views of the temporomandibular joints.

Dissections of the long axis of the joints showing normal and abnormal masticating mechanisms and their relations with the ears (Fig. 4) illustrate important criteria of temporomandibular joint relationships that are not shown by lateral roentgenograms. These dissections show that the posterior and medial bony wall

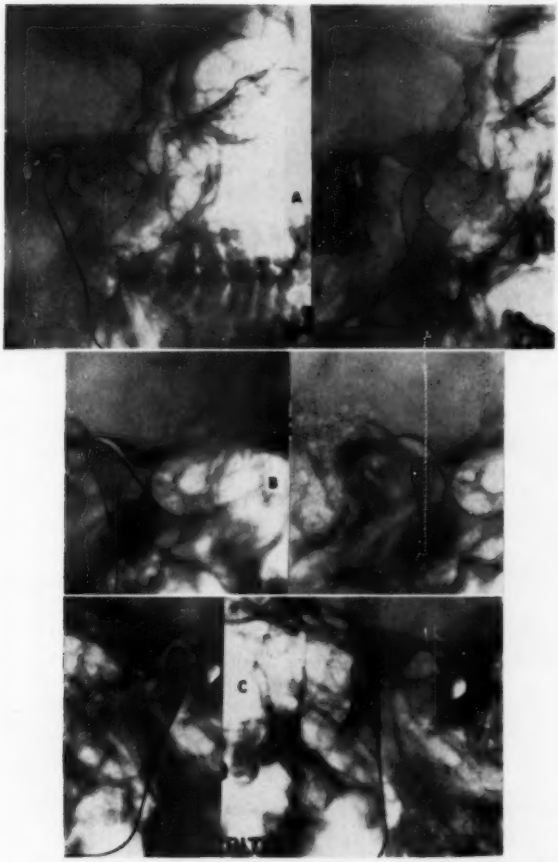

Fig. 1 • Lateral views showing temporomandibular joint with teeth in occluded and open positions. A: normal dental occlusion. B: Class II malocclusion (subarthrosis). C: Class I malocclusion (dysarthrosis)

of the joint fossa is also the anterior lateral bony wall of the auditory meatus, middle ear and eustachian tube. They also show that the form and relation of the condyle and bony wall of the fossa and ear are dependent on the intermaxillary relation and the dental occlusion. If the latter are normal, the condyle is olive-shaped with a smooth, rounded surface and is situated 3 to 5 mm. anterior and lateral to the bony wall of the fossa and ear. If the intermaxillary relations are abnormal and the dental occlusion is traumatic, the relation and form of the joint and ear are abnormal.

The long axis, joint-ear relations are significant because the region between the condyle and joint-ear wall is traversed by branches of the trifacial nerve, external carotid artery and pterygoid venous plexus (Fig. 5) which provide the neurovascular supply of the joint, meatus, ear drum, middle ear and eustachian tube.

The long axis form and relation of the

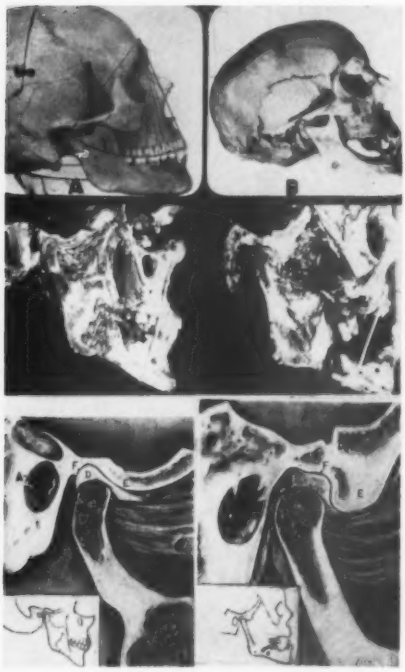

Fig. 2 • Dry and wet specimens showing form and relationship of temporomandibular joints. A: normal occlusion. B: deteriorated occlusion

joint and adjacent structures of the ear are shown in vertex temporomandibular joint roentgenograms. Vertex views are essential for the diagnosis of occluso-joint conditions which cause joint and ear symptoms and for guidance of scientific, therapeutic dentoprosthetic rehabilitation.

Lateral and vertex views are used in dentoprosthetic rehabilitation for roentgenographic studies of the joints to determine the patient's present occlusion, for duplicate studies with bite-block normalized intermaxillary relations, and for subsequent studies during and after rehabilitation. In order to fulfill these requirements, temporomandibular joint roentgenography must permit duplicate lateral and vertex roentgenograms that are as available to the dentist as are roentgenograms of the teeth. This has been accomplished through the development of the apparatus shown in Figure 6. This instrument[6] directs and focuses the central x-ray beam in a radiopaque sleeve at a given angle through the region to be viewed on a segment of the film. The sleeve has windows which have centering marks and expose one quarter or one half of the film to the x-ray. Use of the sleeve guides multiple, duplicate roentgenograms of the joint-ear areas on an 8 by 10 film. The projected x-ray beam is confined in a long radiopaque tube which concentrates the beam, provides maximum definition with minimum exposure, and helps to protect the patient and operator from radiation.

LATERAL VIEWS OF TEMPOROMANDIBULAR JOINTS

Lateral roentgenograms of the joint-ear region are made by placing the condyle point or the ear tragus in contact with the centering mark on the plastic window of the cassette sleeve of the Spot-Focusing Selector. The 20 degree guide rod is placed on top of the sleeve and the long cone is moved into contact with the head and is locked in place. The cone of the dental x-ray machine is placed in the open end of the tube (Fig. 7,A). The film is placed in the sleeve to expose one quarter and the roentgenogram is taken. The first roentgenogram is of the joint taken with the patient's teeth in their normal centric occlusion. With the head held in position and the film moved to expose its second quarter, the next view may be of the joint showing open jaw relations or after insertion of a corrective bite-block. These will provide duplicate views of the auditory meatus, fossa, and articular eminence and demonstrate the varying relations with the condyle (Fig. 8). The exposure time for the standard 65 kv., 10 ma. dental machine with royal blue or other fast film and fast intensifying screen is 2 to 2½ seconds, depending

on the dimension of the head and thickness of bone.

VERTEX VIEWS OF TEMPOROMANDIBULAR JOINTS

Vertex roentgenograms of the joint-ear region are made with the patient's head tilted back until the condyle and gonion are horizontal. The Spot Focusing Selector is set up with one half of the film exposed in the cassette sleeve and the horizontal guide bar in position. The cassette is placed in contact with the crown of the patient's head. The long tube is moved on the guide bar to contact the patient's submaxillary area. The cassette and long tube are rotated laterally until the condyle point or ear tragus is sighted in the latero-central portion of the lumen of the long tube. The x-ray cone is then placed in the open end of the long tube, the patient is instructed to hold his teeth in centric occlusion, and the exposure is made (Fig. 7,B). As in the lateral views, the first roentgenogram is of the joint-ear region with the patient's teeth in normal centric occlusion. Subsequent views of the same region may be made to show intermaxillary relations after correction with a bite-block (Fig. 9-11). These will provide duplicate views of the cranial and ear regions with the altered condyle relationships. The exposure time for vertex roentgenograms is 3 to 3½ seconds under the same conditions as specified for the lateral views.

INTERPRETATION OF ROENTGENOGRAMS

To interpret roentgenograms of pathologic temporomandibular joints, a comparison is made of their outline form and relation with those of normal temporomandibular joints. The normal outline of the joint fossa consists of a smooth, shallow, undulating curvature of the mandibular fossa and articular eminence. The posterior limit of the normal fossa is the

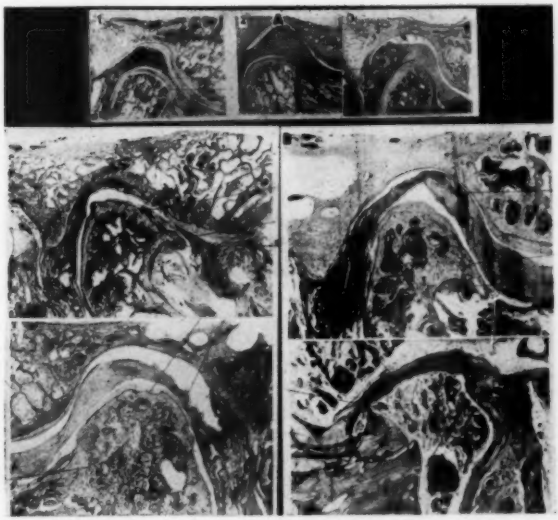

Fig. 3 • Temporomandibular joint forms and relationships with A 1: shallow occlusion; A 2: flat occlusion; A 3: deep normal occlusion; B: deteriorated abnormal dental occlusion (Steinhardt)

lip of the glaserian fissure between the tympanic and petrous portions of the temporal bone. The condyle has a smooth, rounded surface and is situated in the lower forepart of the mandibular fossa when the teeth are occluded in normal centric relation (Fig. 1,A, 2,A, 3,A,). With the opening of the jaw, the condyle is transposed in a rotary, gliding movement to a position just below the crest of the articular eminence (Fig. 1,A, and 8).

Abnormalities of outline and of relationships of joints that are associated with dental disharmonies and malocclusions include a deep fossa, steep fossa-eminence curve, and deformity and roughening of the condyle and eminential surface. The condyle in its position when the teeth are in occlusion may be displaced into posterior and superior relation to the fossa, resulting in erosion of the lip of the glaserian fissure and approximation of the condyle with the auditory meatus. The lumen of the auditory meatus may be diminished and its surrounding bone sclerosed, (Fig. 1,B, 1,C, 2,B, 3,B and 12,A). When the jaw is open the position of the abnormal temporomandibular joints may be characterized by posterior or anterior displacement (Fig. 1,B and 1,C). Previous articles have suggested the diagnostic term "mandibular subarthrosis" for the posterior displacement and foreshortening of the arc of condyle movement and "mandibular dysarthrosis" for the joint condition characterized by posterior displacement of the condyle from its position in normal occlusion and anterior displacement of the condyle when the mouth is open.

Interpretation of vertex temporomandibular roentgenograms is also based on comparison with those of the normal joint-ear region. In order to show the anatomy of the long axis of the joint and its relation to the ear (Fig. 4), a technic

Fig. 4 • Dissections of long axis of temporomandibular joint. A: Normal form and interrelationships of condyle (c) and bony wall of fossa (8,9), auditory meatus (a), middle ear (5), and eustachian tube (8-EO) of normal dental occlusion. B: Pathological form and relationships of displaced condyles (c) and meniscus (3), condyle spur (s), perforation of auditory meatus (a) and eustachian tube (E), and degeneration of cartilagenous eustachian tube (E.T.) caused by deteriorated dental occlusion.

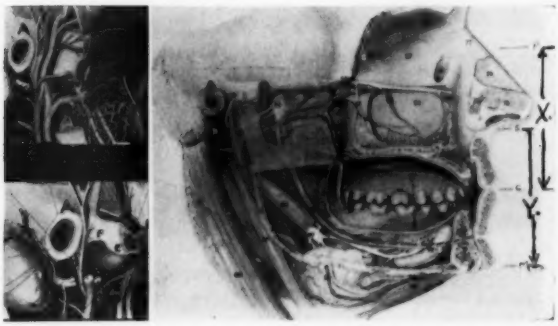

Fig. 5 • Nerves and vessels which normally pass between and supply the joint and ear. Deteriorated dental occlusion will cause joint abnormalities which injure nerves, vessels and tissues of joint and ear

of modified vertex roentgenography was developed (Fig. 7,B). This directional approach eliminates the superimposition of the gonial angle of the mandible and provides an accurate outline of the condyle and its relation to the ear. Figure 9 shows the characteristics when there is normal occlusion. These characteristics are the smooth, rounded surface of the olive-shaped outline of the condyle and the space between the condyle when the teeth are in occlusion and the bony wall of the fossa which is traversed by the nerves and vessels that supply the joint and ear. Also, the wall of the fossa is the bony wall of the external auditory meatus, ear drum, middle ear and eustachian tube.

Vertex roentgenograms of abnormal joints associated with loss and disharmonies of occlusal tooth structure show that the resultant posterior displacement and trauma of the condyles cause alterations of the outline form and relation of the condyle and bony wall of the joint and ear. The abnormality may consist of displacement of the condyle and distortion of the bony wall of the fossa and ear (Fig. 3,B, 10,A) or of distortion and roughening of the posterior and medial surfaces of the condyle associated with approximation with and distortion of the bony wall of the joint and ear (Fig. 11,A). The abnormality may include erosion and penetration of the anterior wall of the meatus (Fig. 4,B), or of the lateral wall of the middle ear and eustachian tube (Fig. 12,A).

APPLICATION OF CRITERIA

The seriousness of the symptoms and dysfunctions which may be caused by inadequate dental treatment and associated mandibular joint pathology is illustrated by the experience of one of us (H.T.K.) which initiated a controlled medical and dental study of vertigo caused by abnormalities of the masticating mechanism. The observations of this six year research have been reported to the American Association for Advancement of Science[7] and the American Equilibration Society.[8] These studies showed that dental occlusal-mandibular joint abnormalities frequently cause dizziness, nausea, vomiting, and syncope or black-out. The attacks may be extremely severe and may occur paroxysmally without warning and endanger the life and security of the patient and his family. Present knowledge among physicians regarding these symptoms is confused and frequently erroneous diagnoses and unsuccessful treatment are the result. Our study showed that the vertigo in 77 of 101 patients was attributable to dental occlusal disorders, and that dentoprosthetic rehabilitation, correlated with supportive medical treatment, completely relieved the vertigo of 70 of the 77 pa-

tients treated.[8] The following case histories illustrate some of the typical successfully treated instances in which the vertigo was severe.

Case 1 • A man, aged 51, had a severe attack of dizziness, nausea, vomiting, diarrhea and syncope in 1953. This recurred without warning with great frequency during a three week period. A team of specialists including neurologist, otologist, encephalologist, radiologist, gastroenterologist and internist failed to find the cause or alleviate the symptoms. Clinical dental examination showed extensive crown and inlay reconstruction of a complete dentition, of which the occlusal plane was irregular and traumatic. The opening movement of the jaw was irregular with a primary left shift and crepitus in the left temporomandibular joint. Ear symptoms included reduced acuity with ringing and fullness of the left ear. These findings, and those after study of the mounted models and the roentgenograms of the temporomandibular joints, indicated a diagnosis of vertigo attributable to dental occlusal-temporomandibular joint pathologic condition which we now term "mandibular vertigo."

The first phase of dentoprosthetic treatment consisted of insertion of cast gold overlays on upper and lower molars and bicuspids to establish normal joint-ear relationships in accord with criteria based on temporomandibular roentgenograms. These overlays were equilibrated so that articulation was harmonious. The vertigo was completely relieved and the joint crepitus and irregular jaw movements eliminated. After two months, the treatment overlays were reproduced and replaced by onlay and crown rehabilitation. There has been no recurrence of the vertigo and associated symptoms during the past six years.

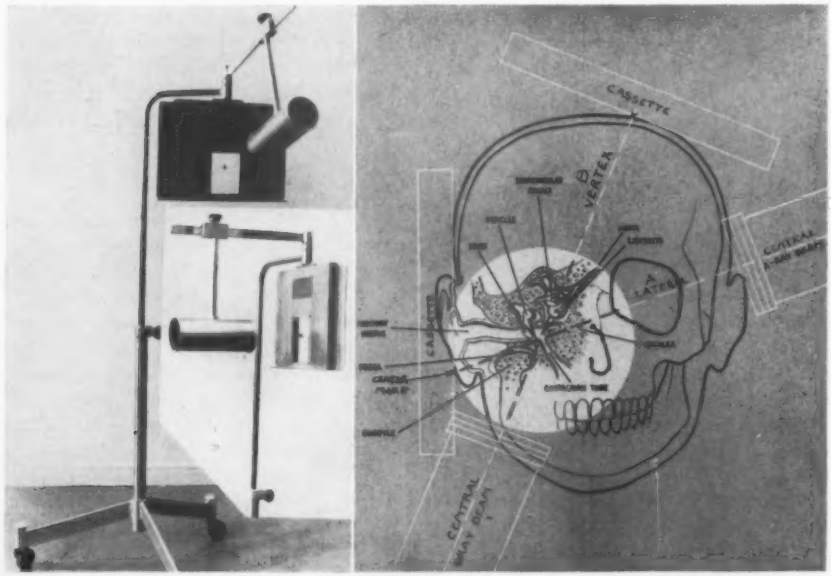

Fig. 6 • Spot Focusing Selector and sketch of areas shown by lateral and vertex views of temporomandibular joint

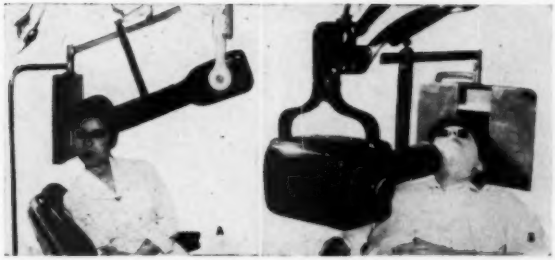

Fig. 7 • A: Application of Spot-Focusing Selector. B: Vertex temporomandibular joint roentgenography

Case 2 • The patient, a woman, aged 41, had a Class I malocclusion with steep cusps and deep overbite. In 1950, her lower molars and bicuspids had been reconstructed to articulate with unreconstructed upper teeth. This treatment did not take into account the temporomandibular joint, and trifacial neuralgia, vertigo and dental discomfort followed. The previous dentist and physician attributed these symptoms to psychoneurotic causes. Two years of psychiatric treatment failed to alleviate the symptoms. Our diagnosis, based on roentgenograms (Fig. 10,A), showed that the rehabilitation had caused displacement of the condyle which resulted in pathogenic relationship with the auditory meatus, eustachian tube and middle ear and probably caused the neuralgia and vertigo. Repetition of the roentegenographic studies after a bite-block correction (Fig. 10,B) showed that rehabilitation to the bite-block-guided intermaxillary relation would establish normal relation of the condyle to the auditory meatus, eustachian tube

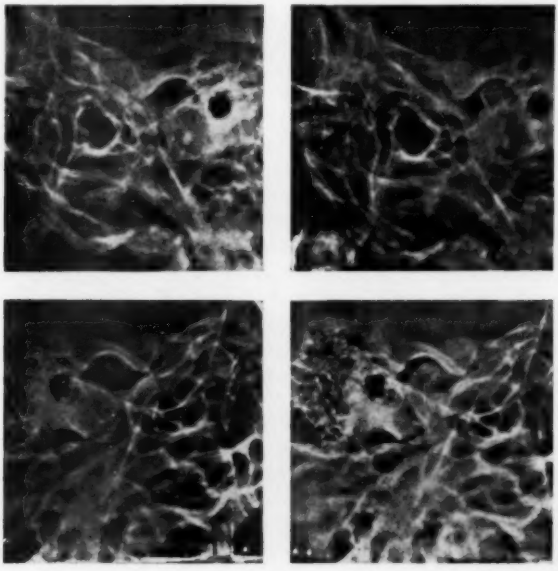

Fig. 8 • Normal lateral views of joints with teeth possessing normal occlusion in closed and open positions on single film made possible by Spot-Focusing Selector

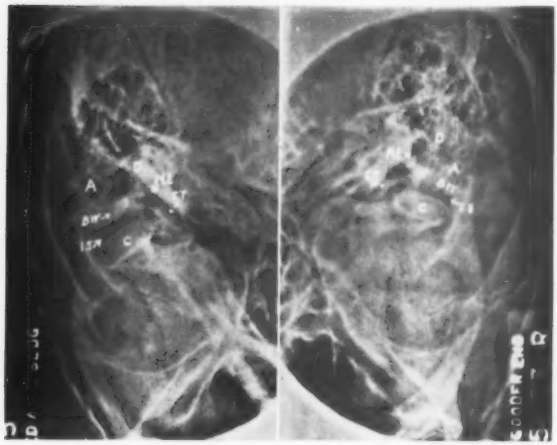

Fig. 9 • Vertex view of right and left joint-ear area provided by Spot-Focusing Selector. Teeth are in normal occlusion

and middle ear. Dentoprosthetic rehabilitation in conformity with these roentgenographic criteria resulted in complete relief of all symptoms and dental comfort. There has been no recurrence of symptoms during the past three years.

Case 3 • In May 1954, a man, aged 56, had a history of vertigo, neuralgia with eye-pressure and blurred vision for the previous 18 months. Clinical examination and model studies showed abnormal dental occlusion associated with attrition of occlusal enamel, loss of teeth with inadequate restoration and replacement. Roentgenograms of the temporomandibular joints showed pathogenic joint-ear relationships. Our diagnosis was vertigo and reflex neuritis of the trigeminal nerve attributable to the pathologic condition caused by faulty occlusion and resultant temporomandibular joint difficulties. This diagnosis was rejected by the patient's previous physician and dentist who attributed the patient's symptoms to psychogenic causes. During the following year, psychiatric treatment included 14 electric shock treatments and several months of institutional confinement. This resulted in a loss of one year of productivity as a teacher of physics, endangered his future security, and did not relieve his symptoms. In June 1955, this patient returned for dentoprosthetic rehabilitation in accord with the criteria based on temporomandibular joint roentgenograms. This treatment resulted in complete relief of all symptoms and there have been no recurrences during the past three and a half years.

Case 4 • A woman, single, aged 30, had paroxysmal attacks of dizziness, nausea, vomiting and syncope or black-out. The attacks had begun when the patient was ten years old and had occurred five or six times yearly. During this time, she had received various medical and dental diagnoses and treatment which did not relieve her symptoms. She became extremely fearful and dependent on her mother. The clinical examination and model studies in January 1957 showed a Class II malocclusion the orthodontic treatment of which had included the removal of first bicuspids and third molars. The lower anterior teeth occluded with the palatal gingiva and the upper anterior teeth were fanned out. There

was a tumorous overgrowth of the medial incisor gingiva. The roentgenograms of the joints (Fig. 12,A, 13,A) showed abnormal relationships of the joints and ears. The vertex roentgenograms showed spur formation on the medial surface of the right condyle which had penetrated the eustachian tube and middle ear. The lateral roentgenograms showed posterior-superior malpositioning of the condyles in abnormally deep fossae with a sharp incline of the fossa eminential surface and contact with the sclerosed anterior wall of the auditory meatus. Dentoprosthetic rehabilitation, which corrected the temporomandibular joint-ear relationships, (Fig. 12,B, 13,B) was completed in February 1957. The after-treatment roentgenograms showed that the dentoprosthetic rehabilitation had resulted in resorption of the spur and normalization of the form and relation of the condyle and the surrounding structures of the middle ear. The vertigo and associated symptoms were completely relieved and there has been no recurrence during the past two years. This patient quickly emancipated herself from her former dependence on her mother and achieved a satisfactory social adjustment.

DISCUSSION

The utilization of temporomandibular joint roentgenography in dentoprosthetic rehabilitation is indicated in treatment of abnormalities of the masticating mechanism. In addition to providing scientific criteria for the diagnosis and for the guidance of the degree and type of mandibular repositioning indicated in each case, temporomandibular joint roentgenography reassures the patient and operator during treatment and rewards them with a more scientific and acceptable result which alleviates and prevents seri-

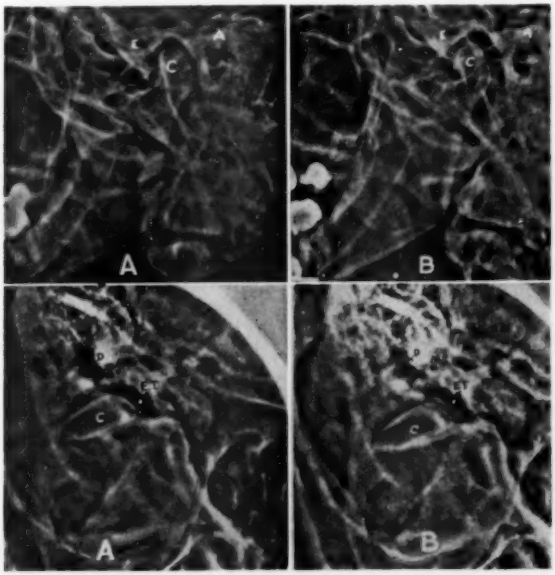

Fig. 10 • Lateral and vertex views of temporomandibular joints show: A: abnormal joint relationships; B: relations after correction of abnormal conditions through use of bite-block

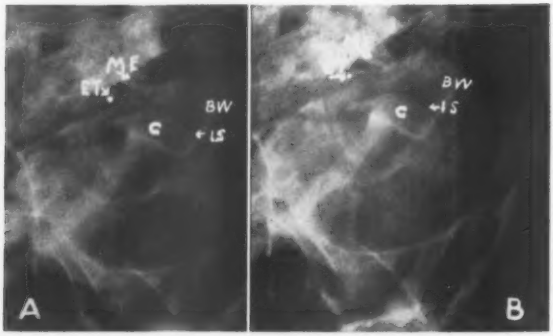

Fig. 11 • Vertex views showing: A: pathogenic relations and form of joint associated with deteriorated occlusion; B: relations after correction by use of bite-block

ous joint and ear symptoms and dysfunctions.

If temporomandibular joint criteria are ignored in empirical dentoprosthetic rehabilitation, the normality of the joint-ear relationship is left to chance and may cause or aggravate joint and ear symptoms.

Empirical treatment has been rationalized on the assumption that temporomandibular joint symptoms are attributable to muscle spasm, and that occlusion of the teeth occurs only with swallowing. Perry[9] showed in his electromyographic studies that although muscle spasms do occur with temporomandibular joint symptoms, they are attributable to occlusal disharmonies and are permanently relieved only when rehabilitation establishes normal temporomandibular joint

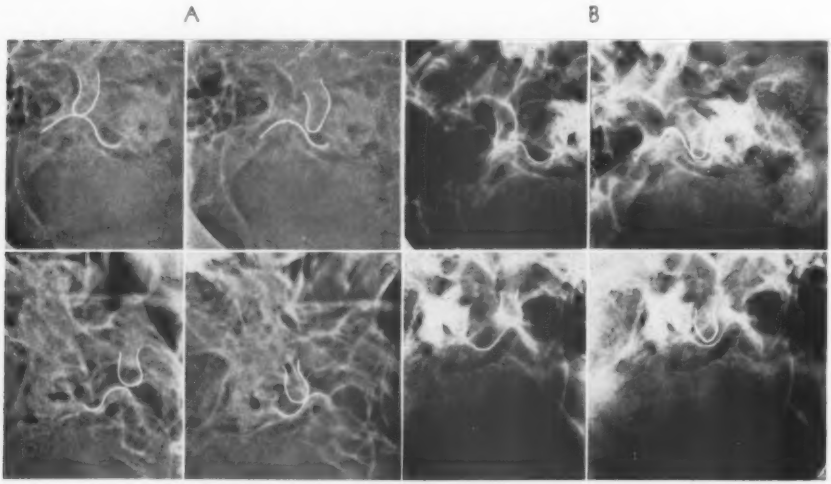

Fig. 12 • Lateral views showing: A: posterior-superior condyle displacement and sclerosis of auditory meatus; B: normal form and relations of joint after dentoprosthetic rehabilitation

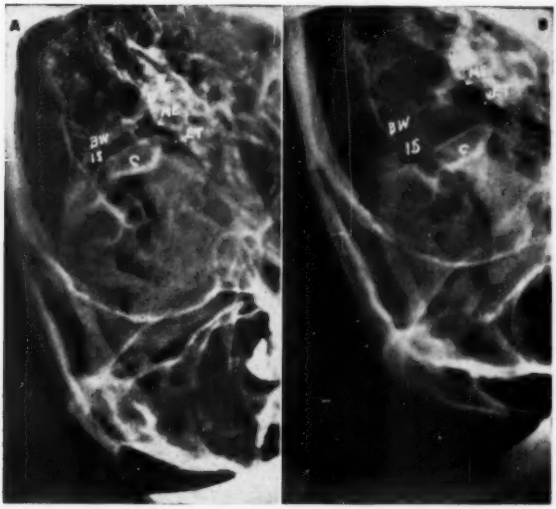

Fig. 13 • A: Vertex view shows distortion and spur of condyle (c) and pathogenic relations of condyle with eustachian tube (ET) and middle ear (ME) in patient with Class II malocclusion. B: normal relationships and form of joint after dentoprosthetic rehabilitation

relations. Jankelson[10] concluded that centric occlusion should provide untraumatic ingress and egress from and to all lateral and protrusive postures of the jaw. This is an excellent definition for harmonious dental occlusion. These findings show that dentoprosthetic rehabilitation requires the establishment of normal temporomandibular joint relation and a harmonious dental occlusion. To accomplish this it is necessary to utilize the criteria based on temporomandibular joint roentgenography. The role of roentgenographic criteria if a harmonious dental occlusion is to be achieved is clear when the dynamics of the relations between the joints and dental occlusion are considered.

The cases reported in this article are from a medicodental study which treated vertigo and associated symptoms by prosthetic rehabilitation. The 70 patients in whom the treatment was effective ranged from age 8 to 89 years. Included were children with malocclusions of deciduous and permanent teeth and adults with deteriorated occlusions and inadequate denture protheses. These patients and their previous dentists and physicians were not aware of their dental inadequacies and temporomandibular joint pathologic conditions, nor of the relationship of these conditions to the vertigo and other symptoms.

Although abnormal intermaxillary relationships and occlusal disharmonies do not invariably cause temporomandibular joint-ear symptoms and dysfunctions, it is the dentists' responsibility to assume that these etiologic potentialities are present in every instance in which treatment involves these factors and temporomandibular joint relationships. The fulfillment of this professional responsibility requires the application of the criteria based on temporomandibular joint roentgenography. This fortifies the dentist, elevates the dental treatment from an empirical

status to that of scientific mandibular orthopedics, and assures normal physiological masticating function and patient acceptance of the dentoprosthetic rehabilitation.

SUMMARY AND CONCLUSION

1. The anatomical and roentgenographic definition of normality of temporomandibular joint form and relationships has been outlined.

2. The normal and abnormal temporomandibular joint relationships have been correlated with normal and abnormal intermaxillary and dental occlusal relationships.

3. A new instrument which simplifies temporomandibular joint roentgenography has been developed.

4. The practical application of the findings and criteria of temporomandibular joint roentgenography in diagnosing temporomandibular joint pathologic conditions and in prescribing and guiding dentoprosthetic rehabilitation has been demonstrated.

5. In 70 patients dental occlusal-temporomandibular joint disorders caused joint and ear symptoms and diseases which were alleviated by dentoprosthetic rehabilitation guided by the criteria based on temporomandibular roentgenography.

The severity of the pathologic conditions and symptoms of temporomandibular joint-ear abnormality caused by dental occlusal disharmony and the present confused status of the treatment of joint and ear symptoms show the importance of the application of temporomandibular joint roentgenography in dentoprosthetic rehabilitation.

901 Medical Arts Building

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Power of Observation • There is nothing in which people differ more than in their powers of observation. *John Burroughs.*

Physical properties of synthetic-rubber-base dental impression materials

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The physical properties of 14 brands of synthetic-rubber-base impression materials (ten brands of polysulfide material and four brands of silicone material) were investigated. The rubber base dental impression materials have physical properties that compare favorably with those of the hydrocolloids. At mouth temperature, setting times ranged from four to ten minutes. Working time varied from less than two to more than six minutes. The temperature rise during curing was too small (3° to 5°C.) to be objectionable clinically. The rubber base impression materials probably should be left in the mouth for ten minutes or longer to minimize permanent deformation on removal.

In recent years new elastic materials for dental impressions have appeared on the market. They are basically synthetic rubbers, either of the polysulfide polymer or silicone type. In both types the base material is supplied in a collapsible metal tube, with the accelerator for the polysulfides also supplied in a tube and the accelerator for the silicones supplied in either a polyethylene dropping bottle or in tubes designed to deliver drops of material. The material is prepared for dental use by spatulating the component parts together for 30 seconds to two minutes, depending on the manufacturer's directions.

An analysis of one polysulfide base material has been reported by S. L. Pearson[1] and the following composition was established:

Base	%
Polysulfide rubber	79.72
Zinc oxide	4.89
Calcium sulfate	15.39
Accelerator	
Lead peroxide	77.65
Sulfur	3.52
Castor oil	16.84
Other	1.99

The chemical reaction that occurs when the polysulfide base material and accelerator are mixed has been studied extensively.[2-5] The metallic peroxide in the accelerator reacts with the polysulfide rubber to form an intermediate compound and water. The sulfur in the accelerator then reacts with the intermediate compound to form the end product and the metal's sulfide as follows:

$$2\ \mathrm{HS\text{-}(RSS)_{23}R\text{-}SH} + \mathrm{PbO_2} \rightarrow \mathrm{[\text{-}S(RSS)_{23}RS\text{-}]_2Pb} + 2\ \mathrm{H_2O}$$

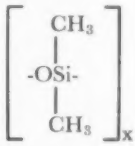
$$n\,\mathrm{[\text{-}S(RSS)_{23}RS\text{-}]_2Pb} + n\ \mathrm{S} \rightarrow \mathrm{[\text{-}S(RSS)_{23}RSSR(SSR)_{23}S\text{-}]_n} + n\ \mathrm{PbS}$$

where $\mathrm{R} = \mathrm{C_2H_4\text{-}O\text{-}CH_2\text{-}O\text{-}C_2H_4}$

Table 1 • Materials investigated

Brand name	Batch numbers	Manufacturer
Polysulfide materials		
Coe-Flex	SS2, E4	Coe Laboratories, Inc.
Dura Flex	None	Reliance Dental Mfg. Co.
Form-Flex	5205, 6171	The William Getz Corp.
Neo-Plex	26455, 19856	Surgident, Ltd.
Paragel	105, 110, 6102	Dental Perfection Co.
Permlastic	LL986MM128/583, NN652NN666/663	Kerr Manufacturing Co.
Plastodent	A11725, A81564	Plastodent, Inc.
R-28	5278, 6255	The William Getz Corp.
Sta-tic	None, Lot 1	Stalite, Inc.
Sta-tic "X"	None, Lot A	Stalite, Inc.
Silicone materials		
Elasticon	PP146PP271/744	Kerr Manufacturing Co.
Silicone Elastic Impression Material	None	The Ransom & Randolph Co.
Sili-Gel	100, 745, 749	Dental Perfection Co.
Syringe Elasticon	OP139PP266/744	Kerr Manufacturing Co.

A text on the technology of silicones by R. R. McGregor[6] gives information on the theory and application of these materials. The silicone material before vulcanization may be a linear polymer of the form



although phenyl and other groups may be present in preference to the methyl groups. Vulcanization is promoted by free radicals formed from benzoyl peroxide, dibutyl tin dilaurate or some similar catalyst.[6,7]

MATERIALS INVESTIGATED

At the time this work was begun, ten brands of impression material of the polysulfide type were available. Somewhat later, four brands of the silicone type became available. All 14 were included in the study although not all tests were run on each of the materials. The materials are listed by brand name, batch number when available, and manufacturer in Table 1.

EXPERIMENTAL PROCEDURE AND RESULTS

Unless otherwise stated, the materials were mixed according to the manufacturers' directions and tested at a room temperature of 22 ± 1°C. (71.6 ± 1.8°F.) and a relative humidity of 53 ± 7 per cent. When tests were conducted under simulated mouth conditions, the specimens were conditioned, and in some instances tested, in water at 37 ± 1°C. (98.6 ± 1.8°F.). Except where noted, all tests were conducted in triplicate and the data and curves given are the averages of the data taken on three specimens. Polysulfide materials are designated by num-

bers 1 through 10. Silicone materials are numbered 11, 13, 14 and 15. The numbers are not related to the order in which the materials are listed in Table 1. Material 14 set too slowly to provide data for most of the tests.

Setting Time • Setting time was determined by the use of a penetrometer with a 1 mm. diameter flat-ended needle under a 100 Gm. load. Specimens of uniform thickness were made by placing the impression material in holes 5 mm. (0.20 inch) in diameter in a 5 cm. by 6 cm. brass plate 8.1 mm. (0.32 inch) thick. Only one penetration was made on each specimen. The depth of the penetration was measured by means of a dial gauge.

Tests were made at both room temperature and mouth temperature. All tests were made with the specimens under water to minimize the adhesion of uncured and partially cured materials to the penetrometer needle. The specimens were placed under water two minutes after the beginning of the mix. At 30 second intervals thereafter the needle was placed on the surface of a specimen and released. At ten seconds after the needle was released a reading of the dial gauge in thousandths of an inch was recorded. When the depth of penetration was essentially constant or gave no definite indication of increasing for three or more readings, the measurements were discontinued.

Figure 1 shows curves for the depth of penetration versus time from the start of mix for two brands of the polysulfide type of material at both 37°C. (98.6°F.) and 22°C. (71.6°F.). Each curve is based on one series of specimens; that is, one specimen at each 30 second time interval. The two curves for specimens at 37°C. show, respectively, the abrupt change in the rate of cure exhibited by some materials and the more gradual change characteristic of other materials. The two curves for specimens at 22°C. show that lower temperatures result in a more gradual change in curing rate for both brands of the polysulfide material. A gradual change in the rate of cure makes the determination of a definite setting time for a material difficult.

To arrive at a definite setting time that would not include the long period of very slow curing at the end of the setting period, and to minimize the effect of slight variations in the surface level of the specimen, a smooth curve was drawn through each series of points, and the time as indicated by the curve when the penetration was 0.010 inch greater than the minimum penetration was called the setting time. Average setting times determined by this method, based on three

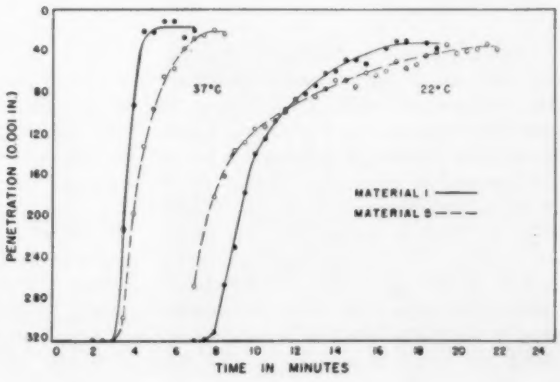


Fig. 1 • Representative curves for setting time as indicated by the depth of penetration versus time for two different polysulfide materials at 22°C. and 37°C. Penetrometer used had 1 mm. diameter needle and 100 Gm. load

Table 2 • Temperature rise and setting time of synthetic rubber base impression material

Material	Temperature rise* above 22°C. (71.6°F.)		Setting time in minutes	
	°C.	°F.	22°C. (71.6°F.)	37°C. (98.6°F.)
4	3.0	5.4	9	4.0
6	3.7	6.7	11	4.5
1	4.1	7.4	14	4.5
9	5.2	9.4	11	5.0
8	4.8	8.6	15	6.5
2	4.8	8.6	16	7.0
10	4.8	8.6	16	7.5
5	4.3	7.7	18	7.5
3	5.2	9.4	30	8.0
11	3.3	5.9	15	9.0
7	3.9	7.0	24	9.0
13	—	—	—	9.0
15	—	—	—	10.0

*Specimen volume was 1.5 cc.

series of specimens for each material at the temperature indicated, are shown in Table 2. Variations in setting time between different brands at the same temperature and in the same brand at different temperatures are evidenced. At 22°C. the values for individual specimens of material 3 had a range of 11.5 minutes. The maximum range for the other materials at this temperature was four minutes. At 37°C. the maximum range was two minutes.

Temperature Rise on Setting • The temperature rise of the polysulfide materials and silicone material 11 on setting at room temperature was determined. Specimens were formed by placing 1.5 cc. of the material in brass rings 16 mm. (0.63 inch) in diameter by 7.5 mm. (0.30 inch) high. Increase in temperature was measured with a thermocouple placed in the center of the specimen. Thermocouple wires of 30 gauge (0.01 inch) or less were used to minimize heat loss by conduction along the wires. It was found that the peak of the temperature rise occurred before the materials reached their clinical set. The temperature rise varied from 3.0°C. (5.4°F.) to 5.2°C. (9.4°F.) for the materials tested (Table 2).

Working Time • The working time was determined by the use of a penetrometer with a 4 mm. diameter flat-ended needle under a 50 Gm. load. The material, mixed according to the manufacturer's directions, was placed in a ring 15.9 mm. (0.62 inch) high and 28.6 mm. (1.12 inch) in diameter, resting on a flat plate and immersed in a room-temperature water bath. At one and a half minutes from the beginning of the mix, the needle was placed on the surface of the specimen and released. At the end of five seconds the thickness of the unpenetrated portion of the specimen below the penetrometer needle was determined to the nearest 0.001 inch by means of a dial gauge. The needle was then removed and similar readings were taken at 30-second intervals.

The time of the last reading at which the unpenetrated thickness of the specimen was 0.010 inch or less was considered to be the working time.

The initial penetration for material 7 was begun at two minutes from the beginning of the mix because of the longer mixing time for this material.

The curves obtained are shown in Figures 2 and 3. The curves shown are based on one specimen each of materials 3 and 7, two specimens of material 15, and three specimens each of the other materials. The specimen of material 14 tested had 0.00 unpenetrated distance for longer than six minutes. The maximum variation observed in working time for individual specimens of any one brand was a half minute.

Strain and Set • Strain and set or "permanent deformation" were determined on materials 1 through 11 by the procedure described in American Dental Association Specification No. 11 for Hydrocolloidal Impression Materials—Agar Type, January 1941.[8] According to this procedure, the specimens one hour after start of mixing are subjected to stresses of 100 Gm./cm², 1000 Gm./cm², 0 Gm./cm², and 100 Gm./cm² in that order, with each load on the specimen for approximately one minute. The strain is calculated from the difference in the length of the specimen under the initial 100 Gm/cm² stress and the 1000 Gm./cm² stress. The set or permanent deformation is calculated from the difference in the length of the specimen under the initial and final 100 Gm./cm² stresses. The readings are made 30 seconds after the application of the load. The materials were also tested at times other than one hour after mixing. The results are shown in Figures 4 and 5. All materials tested complied with American Dental Association Specification No. 11 for strain; that is, the strain was not less than 4.0

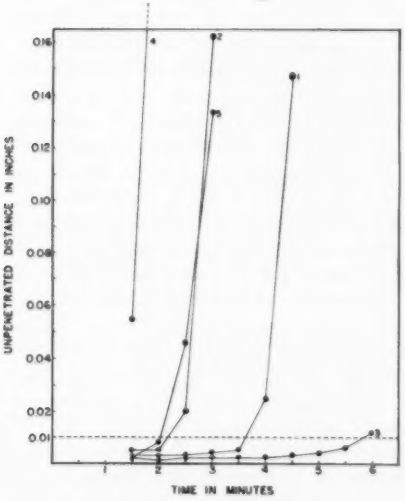


Fig. 2 • Working time for materials 1 through 5 as indicated by unpenetrated distance versus time. Final reading in minutes at which unpenetrated thickness is 0.010 inch or less is considered working time. Penetrometer used had 4 mm. diameter needle and 50 Gm. load

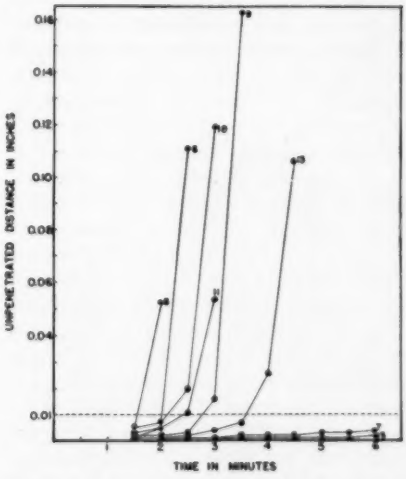


Fig. 3 • Working time for materials 6 through 15 as indicated by unpenetrated distance versus time. Final reading in minutes at which unpenetrated thickness is 0.010 inch or less is considered working time. Material 14 had 0.00 unpenetrated distance for longer than 6 minutes

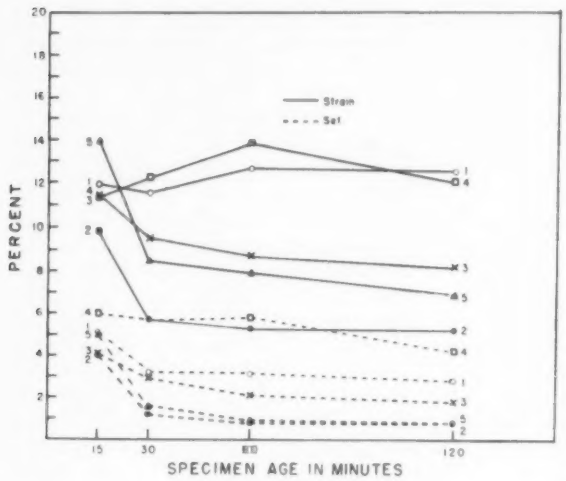


Fig. 4 • Per cent strain and set at 22°C. for materials 1 through 5 using procedure of A.D.A. Specification No. 11. Maximum ranges of values for individual specimens: Strain—5.5 per cent. Set—material 1 at 30 minutes, 3 per cent; all others, 2 per cent or less

per cent or more than 20.0 per cent at one hour after start of mixing. Seven materials including the one silicone so tested complied with the requirement of American Dental Association Specification No. 11, which permits a maximum set of 3 per cent at approximately one hour.

Three materials of the polysulfide type and one of the silicone type were also tested for set at room temperature by the method set forth in Federal Specification U-I-498, Impression Material, Hydrocolloidal, Alginate Type, Dental, May 10, 1953. In this test, set is calculated from the difference between the original and final lengths after releasing an applied strain of 12 per cent from the specimen. The strain is applied one hour after the mix is started and is maintained for one minute. The final length is determined one minute after the release of the strain. The results of these tests are compared in Figure 6 with the results for the same materials obtained by the method described in American Dental Association Specification No. 11. The agreement between the two methods regarding the absolute values of the set is not particularly close. The values, however, remain in the same relative order for the four materials. The maximum range in set for individual specimens of any one brand of these four materials was 0.3 per cent by the Federal Specification and 0.7 per cent by the American Dental Association Specification.

Another series of tests was run to obtain strain and set data on materials 1 through 11 under simulated clinical conditions. At the end of one minute from the beginning of the mix the specimens were placed in a 37°C. water bath for different lengths of time, removed, and immediately tested in air as in the American Dental Association Specification test. Material 7 was placed in the water bath after two minutes because of its longer mixing time. Readings were made at 5, 10 and 15 minutes after start of the mix with the exception that no readings were made at five minutes on materials 3, 7 and 11 because they were not sufficiently cured at that time. All specimens on which readings were made had strain values that were between 4.0 per cent and 20.0 per cent at 5, 10 and 15 minutes after the start of the mix (Fig. 7 and 8). Set values of 3 per cent or less

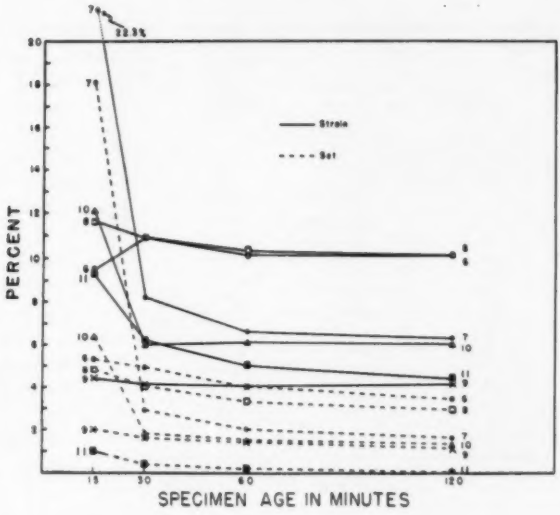


Fig. 5 • Per cent strain and set at 22°C. for materials 6 through 11, using the procedure of A.D.A. Specification No. 11. The value for material 10 at 2 hours is the average of two specimens. Maximum ranges of values for individual specimens: Strain—material 7 at 15 minutes, 11 per cent; all others, 5.5 per cent or less. Set—material 7 at 15 minutes, 16 per cent; all others, 2 per cent or less

were obtained for one material at approximately five minutes after the start of the mix, five materials at approximately ten minutes after the start of the mix and eight materials at approximately 15 minutes after the start of the mix.

In addition to the foregoing tests for permanent deformation and strain, methods from a proposed specification for rubber base impression materials also were used to determine these properties. The specimens were placed in a 37°C. water bath at the end of two minutes from the beginning of the mix. At the end of seven and a half minutes from the beginning of the mix, they were removed from the water bath, and at eight minutes were either compressed as required by the previously mentioned Federal Specification method for determination of set or compressed as required by the American Dental Association Specification method for determination of strain. Results of these tests, made at 22°C., are given in Table 3.

Flow • Flow of the materials under a light load was investigated. As in the tests for strain and set, the specimens were cylinders 12.7 mm. (0.5 inch) in diameter and 19.0 mm. (0.75 inch) long. They were aged in air for one hour prior to testing, and tested at 22°C. A 100 Gm. load, which exerted a stress of approximately 79 Gm./cm², was placed on the specimen by means of a dial gauge with the foot resting on a flat plate on top of

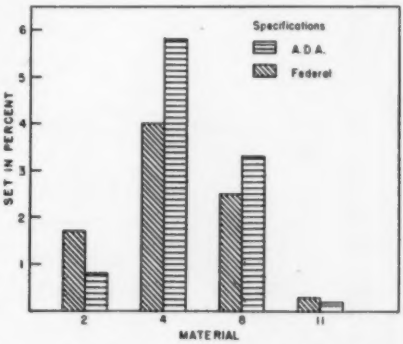


Fig. 6 • Comparison of per cent set as determined by A.D.A. Specification No. 11 and Federal Specification No. U-I-498, at 22°C. The value for material 4 as tested by the federal specification is the average of two readings. All other values are averages of three readings

Table 3 • Permanent deformation and strain at 8 minutes*

Material	Permanent deformation (%)	Strain (%)
15	1.3	30.5
13	1.6	27.3
11	2.4	30.6†
2	3.5	—
1	4.1	—
5	4.5	—
4	4.7	—
9	5.6	—
6	5.9	—
8	5.9	—
10	5.9	—
7	8.8	15.2†
3	‡	24.2
14	‡	‡

*Specimens conditioned at 37°C. and tested at 22°C.
†One specimen.
‡Specimens not sufficiently set to provide test results.

the specimen. A dial gauge reading in thousandths of an inch was taken at the end of 30 seconds after application of load. Additional readings were taken at 15-minute intervals for one hour and the reduction in length of the specimen was considered to be flow. Flow values at one hour after load application were between 0.9 and 5.9 per cent for the polysulfide materials and 0.2 per cent for silicone material 11. As shown in Figure 9, the flow curves for most of the materials approximated straight lines after 15 to 30 minutes under load, indicating that after this period flow was approximately proportional to length of time under load.

Dimensional Stability • Some investigators[1, 9, 10] have determined dimensional accuracy by taking impressions of dies, making restorations and placing the finished restorations back on the original dies to check the fit. In the tests for dimensional stability described here, specimens of each impression material approximately 57 mm. (2.25 inch) by 19 mm. (0.75 inch) by 3.2 mm. (0.125 inch) were made. Small pieces of polished metal on which cross lines had been ruled were imbedded in the surface. The specimens were placed on a glass surface which had been dusted thoroughly with talc, as had the contacting surface of the specimens, permitting the specimens to change dimensions freely on the glass surface. The distance between the ruled lines was measured at various times from 15 min-

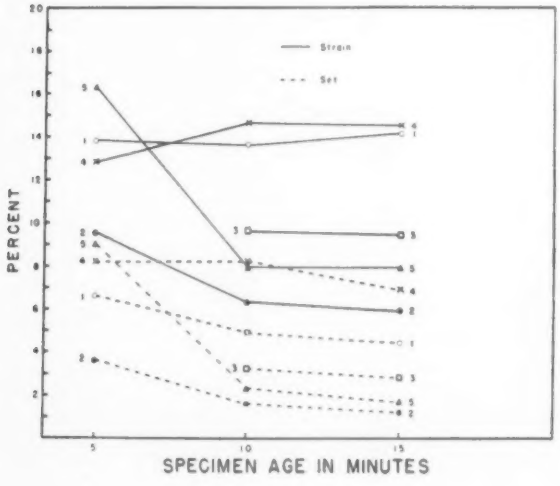


Fig. 7 • Per cent strain and set after aging at 37°C. for materials 1 through 5, using the procedure of A.D.A. Specification No. 11. Maximum ranges of values for individual specimens: Strain—material 1 at 5 minutes, 4.3 per cent; all others, 2.9 per cent or less. Set—material 1 at 5 minutes, 2.1 per cent; all others, 1.2 per cent or less

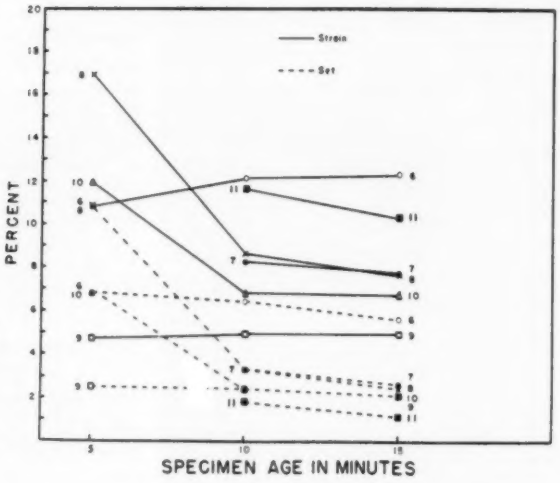


Fig. 8 • Per cent strain and set after aging at 37°C. for materials 6 through 11, using the procedure of A.D.A. Specification No. 11. Maximum ranges of values for individual specimens: Strain—material 11 at 10 minutes, 4.5 per cent; material 11 at 15 minutes, 5.7 per cent; all others, 2.9 per cent or less. Set—material 10 at 5 minutes, 2.7 per cent; all others, 1.2 per cent or less

utes to 24 hours from the beginning of the mix. To eliminate error due to repositioning the specimens, each specimen was left on the table of the measuring microscope until all the measurements on it were completed.

Early in the 24 hour period, some materials showed an immediate decrease in linear dimension, others showed an increase and still others showed no immediate change (Fig. 10). All specimens showed a definite decrease in length over a 24 hour period.

Effect of Synthetic Rubber Base Impression Materials on Impression Compound • In the course of this work it was noted that the accelerators for the polysulfide

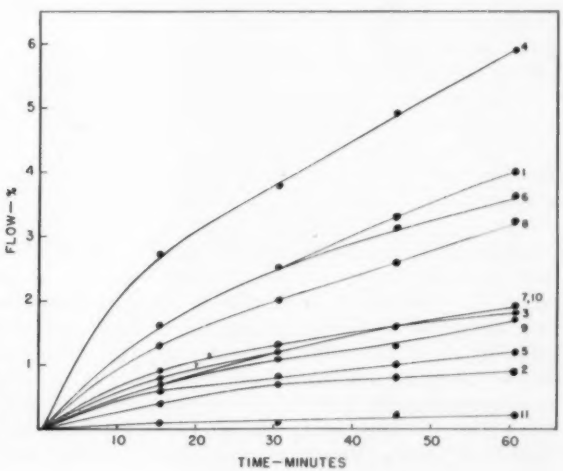


Fig. 9 • Per cent flow at 22°C. under a stress of 79 Gm./cm². Load applied after specimens had aged 1 hour. Maximum ranges of values for individual specimens: Material 1, 1.4 per cent; material 4, 1.0 per cent; material 6, 0.7 per cent; all others, 0.3 per cent or less

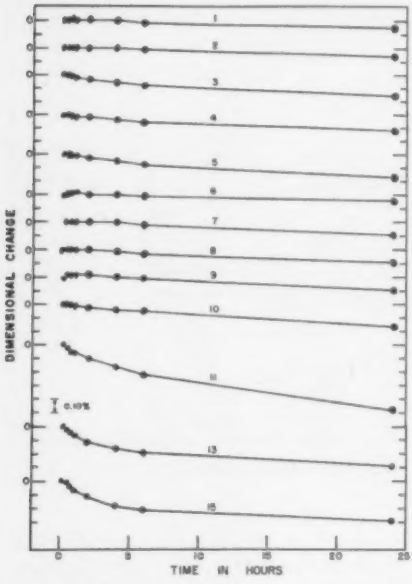


Fig. 10 • Per cent dimensional change versus time. Only two specimens were measured at the following readings: Material 2 at 4 and 6 hours; material 3 at all readings; material 4 at 4 hours; material 7 at 4 hours; and material 10 at 2 and 6 hours. Three specimens were measured to obtain average value at all other readings

and one of the silicone materials had a softening effect on dental impression compound (American Dental Association Specification No. 3). The base materials had no effect. The polysulfide materials when cured had a softening effect on dental impression compound when the two were in contact for several weeks. The other three silicones were not tested in this respect.

Compatibility of Synthetic Rubber Base Impression Materials with Gypsum Materials • To determine the compatibility of these impression materials with gypsum products, all of the polysulfide and the silicone materials were made into specimens approximately 4 by 4 by ¼ inches. When these had aged for 45 minutes, two "improved" stones, one regular stone, one casting investment, one model plaster and one soluble impression plaster were mixed and applied to the surfaces of the impression materials. After two hours the gypsum materials were removed and the contacting surfaces were examined.

In all instances, with the exception of those gypsum products poured against a sample representative of the early production of one silicone material, the gypsum products exhibited a smooth reproduction of the surface of the impression materials. Only the soluble impression plaster gave a smooth reproduction of the surface of this early silicone material. All of the other gypsum products poured against it had pitted and roughened surfaces and some left a film on the impression material. Samples from later production of this silicone material were compatible with gypsum products.

Surface Effects and Detail • Specimens of most of the polysulfide materials displayed depressions on the surface after they had been left standing undisturbed for several hours. The cause of these depressions was not determined. It was observed, however, that the depressions were always located over internal voids near the surface. Figure 11 shows four materials (3, 6, 11 and 13) at ages of 1 hour and 24 hours. The depressions were strongly evident at 24 hours in most materials. In general, this effect was less prominent or absent with the silicone products.

To determine the detail-reproducing characteristics of the material, impressions were made of grooves 0.0015 inch wide ruled on a steel block. The reproduction of detail was excellent for all materials. The maintenance of the detail also was excellent, with the exception of the formation of the surface depressions already mentioned. Examination of models poured against the impressions indicated that the synthetic rubber base materials seem to reproduce detail more

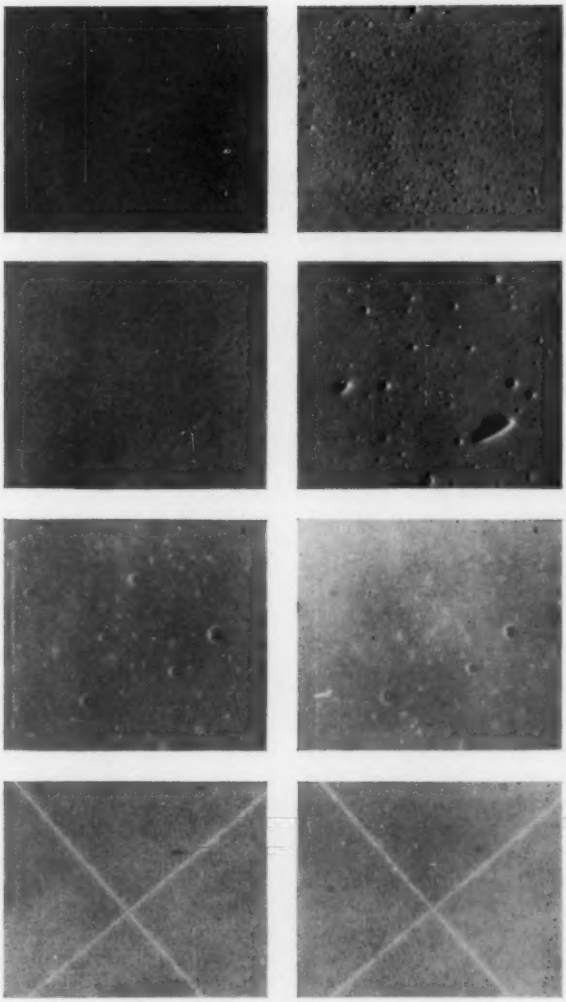


Fig. 11 • Age effects on surface of rubber-base impression materials. Left column shows appearance of surface 1 hour after start of mix; right column shows appearance 24 hours after start of mix. Materials shown are, from top to bottom, 3, 6, 11 and 13. (Magnification approximately 9X)

sharply than it can be transferred to gypsum models even though the materials are compatible.

DISCUSSION

The rubber base dental impression materials have physical properties that compare favorably with those of the hydrocolloids.

The setting times at 37°C. for the rubber base materials are not as short, in some instances, as the gelling time for the hydrocolloids, but in most instances they are not excessively long. The setting time of polysulfide rubbers in general is dependent on the humidity and temperature at which the material is mixed; the higher the humidity or the temperature, the faster is the rate of cure.[2] The magnitude of the effect of moisture on the setting time of the polysulfide material as used in dentistry has not been studied as yet. This dependency may be critical, particularly in tropical areas. Because of the difficulty encountered in determining the setting time by means of the penetrometer test, and because the setting time so determined is dependent on the type of penetrometer used, a more satisfactory test would be desirable. However, if a material possesses a satisfactory working time and also meets the requirements for low permanent deformation shortly after mixing, a setting time test as such would be superfluous and could be omitted from specifications for the materials.

The temperature rise on setting for the rubber base materials is not clinically significant since it amounts to approximately 3 to 5°C. (5 to 9°F.) for 1.5 cc. of material.

As previously noted, the one silicone so tested and six of the polysulfide materials complied with the requirement of American Dental Association Specification No. 11 for set and all materials complied with the requirement for strain. Hydrocolloids do not have excessive changes in physical properties between the time they have gelled and the time at which they are tested in accordance with the American Dental Association Specification requirements. However, the rubber base materials undergo significant changes in physical properties during the time interval preceding the one hour test prescribed by the American Dental Association Specification, as can be seen in Figures 4 and 5. Fairhurst, and others[11] have investigated the strain and set at room temperature of some polysulfide materials at 5, 6, 8 and 10 minutes after the start of the mix. However, in practice, the curing of the material occurs in the mouth at approximately 37°C. It seems advisable to test the rubber base materials at earlier times than one hour, and after aging at a temperature of 37°C. rather than room temperature. The decrease in the set at five minutes to the lower value of set at ten minutes at 37°C. (Fig. 7 and 8) indicates that if the material is kept in the mouth until ten minutes after mixing, set and strain should be within clinically acceptable limits.

The flow of the specimens under a stress of 79 Gm./cm^2 did not appear to be excessive in most of the materials. However, the high values obtained for some materials may be indicative of a tendency for impressions made from these materials to flow and be distorted within a period of several hours.

A definite advantage that the polysulfide materials and, to a lesser extent, the silicone products have over the hydrocolloids is their dimensional stability. Phillips[12] has stated that in no instance can accurate dies routinely be produced from reversible hydrocolloid impressions which are stored for as long as 30 minutes, regardless of the media employed. The polysulfide materials can be stored in air for as long as 24 hours with a decrease in linear dimension of approximately 0.2 per cent or less. The silicone materials tested have an equivalent decrease in dimension in approximately four to six hours. Dimensional changes within this range

probably have little clinical significance. The shrinkage observed in all specimens tested is to be expected as the result of continued vulcanization or polymerization. The advantages of relatively good dimensional stability are nullified to some extent by the appearance of surface irregularities on some of the materials after a few hours. Early pouring of the cast minimizes the effect of both dimensional change and surface irregularities.

One disadvantage of the synthetic rubber base materials is the difficulty of mixing homogeneously the relatively large quantities required for full mouth and other large impressions, although the silicone materials are considerably better in this respect than the polysulfide materials.

SUMMARY

1. Rubber base dental impression materials have physical properties that compare favorably with those of the hydrocolloids. In most of the properties determined, however, there was considerable variation between different brands of materials.

2. At mouth temperature, setting times ranged from four to ten minutes.

3. The temperature rise during curing was too small to be clinically objectionable for all brands tested.

4. Of all the materials tested, only two had working times of less than two minutes, and three had working times of six minutes or longer.

5. In general, the silicone materials exhibited less permanent deformation and greater strain than the polysulfide materials when tested five to ten minutes after the beginning of the mix. The rubber base impression materials probably should be left in the mouth for ten minutes or longer to minimize permanent deformation on removal.

6. All materials tested displayed flow under a light load, and some showed a relatively large amount.

7. All of the materials tested were relatively stable dimensionally, although all showed some degree of decrease in linear dimension with time. The polysulfide materials were more stable than the silicones.

8. All of the materials tested were compatible with gypsum products with the exception of early batches of one brand of silicone material.

9. Most materials displayed depressions on the surface after a few hours, although the number and magnitude of these depressions varied greatly from one material to another.

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†Physicist, dental research section, National Bureau of Standards.

‡Chief, dental research section, National Bureau of Standards.

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Proposed specification for impression material; synthetic rubber base, dental

W. A. C. Miller, Jr., D.D.S.; W. C. Hansen,† B.S.; George Dickson,† M.A., and W. T. Sweeney,‡ A.B., Washington, D. C.*

This proposed specification is based to a large extent on data reported in a paper by the same authors.[1] Test procedures for permanent deformation and strain are modifications of procedures described in Federal Specification U-I-496a for Impression Material, Hydrocolloidal, Agar Type, Dental; Federal Specification U-I-498 for Impression Material, Hydrocolloidal, Alginate Type, Dental; and American Dental Association Specification No. 11 for Hydrocolloidal Impression Material, Agar Type.

Two types of material, silicone base and polysulfide base, are covered in the specification. Although all requirements with the exception of composition are identical for both types, mixing and handling characteristics do differ and the type to be obtained is left to the choice of the purchaser.

Determinations of permanent deformation and strain at 8 to 10 minutes after the material is mixed serve indirectly as requirements that the material set within this period. A requirement for dimensional stability is included since these materials have been recommended for procedures where a considerable delay may occur between making the impression and pouring the cast.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers dental impression materials with a synthetic rubber base, intended primarily for taking oral impressions.

1.2 Classification.

1.2.1 Grade and type. Impression materials covered by this specification shall be of one grade and of the following types as specified in the invitation for bids: Type I, Silicone base; Type II, Polysulfide base.

2. APPLICABLE SPECIFICATIONS AND STANDARDS

2.1 The following Federal Specifications shall form a part of this specification: U-S-746b Stone; Artificial, Quick-Setting (Dental) and U-I-498 Impression Material, Hydrocolloidal, Alginate Type.

3. REQUIREMENTS

3.1 Material. Both the base material and the accelerator shall be uniform in consistency and free of foreign materials and impurities. The manufacturer shall furnish a certificate stating that the mate-

rial contains no poisonous ingredients in sufficient concentration to be harmful to human beings when used as directed.

3.1.1 Composition.

Type I. Silicone base materials shall not reveal any sulfur content when tested by the method in 4.3.1.

Type II. Polysulfide base materials shall reveal a sulfur content when tested by the method in 4.3.1.

3.1.2 Suitability. The material when mixed as directed by the manufacturer's instructions accompanying the package, shall be suitable for taking impressions in the oral cavity.

3.2 Mixing time. The mixing time shall be stated in the manufacturer's directions and shall not exceed one minute.

3.3 Working time. The working time when determined by the method in 4.4.2 shall be not less than 2.0 minutes or less than the manufacturer's stated working time, whichever is greater.

3.4 Detail reproduction. The material shall reproduce a groove 0.0015 inch in width when tested by the method in 4.4.3.

3.5 Compatibility. The material shall be compatible with dental artificial stone when tested by the method in 4.4.4.

3.6 Permanent deformation after compression. The permanent deformation when tested by the method in 4.4.5 shall not exceed 4.0 per cent.

3.7 Strain in compression. The strain in compression shall be not less than 4.0 per cent nor more than 30.0 per cent when tested by the method in 4.4.6.

3.8 Dimensional stability. The change in linear dimensions shall be not more than 0.2 per cent when measured by the method in 4.4.7.

3.9 Deterioration. The permanent deformation when tested by the method in 4.4.5 shall not exceed 4.0 per cent after the material has been stored at 60° ± 1°C. (140° ± 1.8°F.) for seven days in accordance with 4.4.8.

3.10 Instructions for use. Instructions shall include the proportions of material needed for proper mixing, the mixing time, the working time at 23° ± 1°C. and 50 ± 4 per cent relative humidity and the minimum time for leaving the impression in the mouth.

4. SAMPLING, INSPECTION AND TEST PROCEDURES

4.1 Sampling. Unless otherwise specified, a sample consisting of four packages shall be taken at random from each lot or batch of material in the delivery.

4.2 Inspection. Compliance with the requirements of 3.1, 3.1.2, 3.2, 3.10 and 5 shall be determined by visual inspection.

4.3 Chemical tests.

4.3.1 Composition. Three to five grams of base material shall be placed into the bottom of a small glass container. A piece of suitably bent glass tubing shall be connected to the top of the container. The free end of the glass tubing shall be immersed in approximately 10 ml. of 5 per cent $Pb(Ac)_2$ which has been acidified with 1 to 2 drops of acetic acid. The base material shall be heated carefully in the glass container until a visible vapor forms. Heating shall be continued for 2 minutes or until a black precipitate forms in the $Pb(Ac)_2$, whichever occurs first. Formation of a black precipitate shall be considered indicative of sulfur content.

4.4 Physical tests.

4.4.1 Standard testing conditions. All physical tests shall be made under uniform atmospheric conditions of 23° ± 1.0°C. (73.4° ± 1.8°F.) temperature and 50 ± 4 per cent relative humidity. Material before mixing and testing equipment shall be conditioned in the testing room for not less than 12 hours. Material shall be mixed according to the manufacturer's instructions.

4.4.2 Working time. Compliance with the requirement of 3.3 shall be determined by a penetration test. The penetrometer shall consist of a flat-ended cylindrical needle 4 mm. in diameter, through which a load of 50 grams is applied to the specimen, and shall be

equipped with a dial indicator graduated in thousandths of an inch for indicating the depth of penetration. A smooth flat plate shall be placed under the needle and a fiducial reading (A) made. A ring, 5/8 inch high and approximately 1 1/8 inches inside diameter shall be placed upon the plate beneath the needle and filled with material. The top surface shall be leveled. At 2.0 minutes from the start of the mix, or at the manufacturer's stated working time, whichever is greater, the needle shall be placed in contact with the top surface of the specimen and released. At 10 seconds after release, an indicator reading (B) shall be made. The difference between the two readings (B-A) shall be recorded to the nearest 0.001 inch. If the average difference for 3 specimens is not more than 0.010 inch, the material shall be considered to comply with the working time requirement.

4.4.3 Detail reproduction. The ring specified in 4.4.2 shall be positioned on the test block shown in Figure 1, so that the intersection of a crossline and a 0.0015 inch width groove is in the center of the ring. The ring shall be slightly overfilled with a mix of impression material. A flat plate shall be placed on top and the excess material squeezed out. At 2 minutes from the start of mix, the entire assembly shall be placed in a water bath maintained at a temperature of 37° ± 1°C. At 7.5 minutes from the start of the mix, the assembly shall be removed from the bath. The ring with the impression material shall be separated from the test block immediately, and the impression shall be examined under low angle illumination without magnification. The reproduction shall be con-

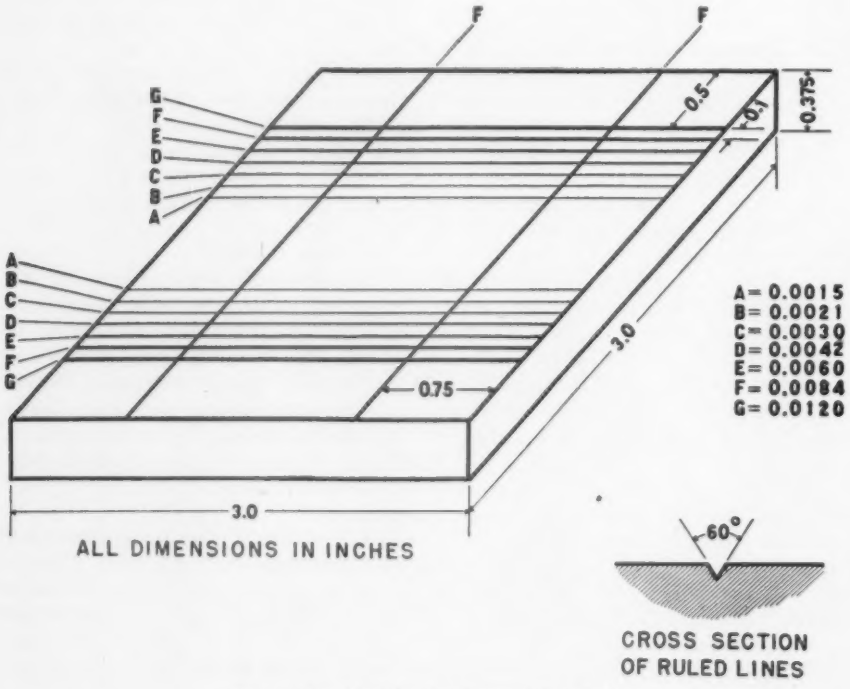


Fig. 1 • Test block for detail reproduction test

sidered to be satisfactory if the 0.0015 inch width groove is continuous for the full inside diameter of the ring. One specimen shall be tested.

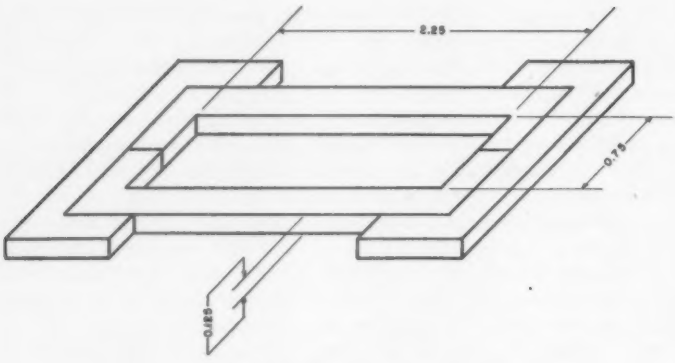
4.4.4 Compatibility. An artificial stone cast shall be poured against the impression made in 4.4.3 within 10 minutes from the time it is separated from the test block. The artificial stone used shall be capable of reproducing a groove 0.0015 inch in width when tested against a test block similar to that shown in Figure 1 and shall comply with Federal Specification U-S-746b. The impression materials shall be separated after the stone has set. The cast shall be examined under low angle illumination without magnification. The impression material shall be considered to be compatible with the artificial stone if the 0.0015 inch width groove is reproduced in the gypsum continuously for the full inside diameter of the ring. One specimen shall be tested.

4.4.5 Permanent deformation.

4.4.5.1 Preparation of the test specimen. A lubricated metal ring mold, 0.5 inch inside diameter, 1 inch outside diameter, and 0.75 inch high, shall be overfilled with impression material. The mold shall be placed on a flat plate and another flat plate shall be pressed on top of the mold to remove the excess material. At 2.0 minutes from the beginning of the mix the mold and accompanying plates shall be immersed in a 37° ± 1°C. water bath. At 7.5 minutes from the beginning of the mix the specimen shall be removed from the water bath and separated from the mold, and at 8.0 minutes it shall be tested by the method described in 4.4.5.2.

4.4.5.2 Test procedure. The specimen shall be placed in an instrument consisting essentially of a dial gauge graduated in thousandths of an inch, mounted to a steady base and equipped with a screw positioned in such a manner that sufficient pressure can be applied to the specimen to produce the required amount of strain as described in Federal Specification U-I-498. At 8.0 minutes from the beginning of the mix a lightweight plate shall be placed on top of the specimen and the foot of the dial gauge shall be brought into contact with the plate. The weight of the plate plus the force of the spring in the gauge shall be 50 ± 5 grams. The dial gauge shall be read 30 seconds after the foot of the gauge contacts the plate and the value recorded as "Reading A." The dial gauge foot shall be lowered 0.090 inch by means of the screw and shall be maintained in this position on the specimen for 1.0 minute, then the foot of the dial gauge shall be raised and the specimen allowed to rest under no load for 1.0 minute. The dial gauge foot shall again be brought into contact with the plate on the specimen for 30 seconds and a second reading shall be taken. This value shall be recorded as "Reading B." The difference between "Reading A" and "Reading B" in inches, divided by 0.75 inch (considered to be the original height of the specimen) and multiplied by 100 shall be considered to be the per cent of permanent deformation. The value shall be reported as the average of tests on three specimens and shall be recorded to the nearest 0.1 per cent.

4.4.6 Strain in compression. A specimen prepared as described in 4.4.5.1 shall be transferred to an appropriate instrument equipped with a dial gauge that will indicate the height of the specimen to one thousandth inch, and at 8.0 minutes from beginning of the mix shall be subjected to a load calculated to produce a stress of 100 grams per square centimeter (1.42 pounds per square inch). Thirty seconds later the dial indicator shall be read. This value shall be designated as "Reading A." Sixty seconds after application of a stress of 100 grams per square centimeter, an additional load calculated to produce a total stress on the specimen of 1000 grams per square centimeter (14.2 pounds per square inch) shall be applied gradually during an interval of 10 seconds. Thirty seconds after initiation of the application of this load,



ALL DIMENSIONS IN INCHES

Fig. 2 • Mold for dimensional stability specimen

a reading of the dial indicator shall be taken. This reading shall be designated as "Reading B." The difference between "Reading A" and "Reading B" in inches, divided by 0.75 inch (considered to be the original height of the specimen) and multiplied by 100 shall be considered to be the per cent of strain.

The value shall be reported as the average of tests on three specimens and shall be recorded to the nearest 0.1 per cent.

4.4.7 Dimensional stability.

4.4.7.1 Preparation of the mold. The mold shown in Figure 2 may be made from metal, polymethyl methacrylate or Teflon.

4.4.7.2 Preparation of the specimen. The mold shall be lubricated with silicone grease and placed on a flat surface which has been covered with a sheet of 0.001 inch-thick polyethylene. Small pieces of metal on which crosslines have been ruled shall be placed with ruled lines down as near as possible to each end of the mold. The two pieces shall be not less than 1.75 inches apart. The metal pieces may be held in position with minute quantities of utility wax or similar substances. The mold shall be slightly overfilled with impression material. Another sheet of 0.001 inch-thick polyethylene shall be placed over the impression material and the excess pressed out with a flat plate. At 12.0 minutes from the beginning of the mix, the polyethylene shall be stripped off and the flash trimmed away before separating the halves of the mold.

4.4.7.3 Test procedure. The specimen shall be dusted with talc on the surface opposite that in which the metal pieces are imbedded, and placed on a smooth glass surface which has also been dusted with talc. The distance between the crosslines on the two pieces of metal shall be measured with a measuring microscope to the nearest 0.001 inch 15.0 minutes after the beginning of the mix and 6 hours after the beginning of the mix. The difference between the two measurements, divided by the 15.0 minute measurement and multiplied by 100, shall be considered to be the change in linear dimension in per cent.

The value shall be reported as the average of tests on three specimens and shall be recorded to the nearest 0.1 per cent.

4.4.8 Deterioration test. One unopened package of the material shall be stored at 60° ± 1°C. (140° ± 1.8°F.) for one week. At the end of the storage period, test specimens shall be made and

tested for permanent deformation in accordance with 4.4.5.

4.5 Compliance. Each lot or batch of material included in the delivery shall be accepted or rejected individually. If the sample (4.1) complies with all of the requirements of this specification, the lot or batch shall be accepted. If the sample fails to comply with any requirement, two additional samples shall be tested. If both comply with all requirements, the lot or batch shall be considered to comply with the specification.

5. PREPARATION FOR DELIVERY

5.1 Packaging. The material shall be supplied in sealed airtight containers from which no leakage shall be discernible.

5.1.1 Instructions. Adequate instructions for manipulation and use of the material shall accompany each package. (See 3.10.)

5.1.2 Amount of material in individual package. The amount of material in each package shall be such that, when the contents are mixed in accordance with the manufacturer's directions, the resulting mix shall have a volume of not less than 130 cc. when measured to the nearest cubic centimeter.

5.1.3 Lot numbers. Each container shall be marked with a serial number or combination of letters and numbers which shall refer to the manufacturer's records for the particular lot or batch of impression material.

5.1.4 Date of manufacture. The date of manufacture (year and month) shall be indicated on the container as a separate item or a part of the lot number (5.1.3).

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1. Miller, W. A. C., Jr., and others. Physical properties of synthetic-rubber-base dental impression materials. J.A.D.A. 60:211 Feb. 1960.

Oral Examinations • For early cancer diagnosis, inclusion of an oral dental examination in the physical evaluation given patients on hospital admission is proving valuable, according to Veterans Administration. VA hospitals adopted the technic about two and a half years ago, and have since reported some 700 cases of malignancies of the mouth, tongue and throat which might otherwise have developed unnoticed until too late for successful treatment. *Hospitals 33:21:66 Nov. 1, 1959.*

editorials

Secretary Flemming of Health, Education, and Welfare urges speed-up of fluoridation

Although fluoridation each year is being adopted by more communities in the United States, the increase in the number of people drinking fluoridated water lags substantially behind the increase in urban population. Arthur S. Flemming, Secretary of Health, Education, and Welfare, warns that if the trend continues, "a rapidly increasing number of children in this country will be deprived of safe, effective and inexpensive protection against one of the most widespread diseases—tooth decay."

Although the nation's urban population has increased since 1956 by about 7,500,000 persons, the number of people drinking fluoridated water during this period has increased by only 4,200,000.

"Why fewer and fewer communities are availing themselves of this proved dental health measure is difficult to understand in view of these facts," Secretary Flemming said.

"More than 25 years of research has shown that water containing a proper amount of fluoride reduces dental decay by more than 60 per cent.

"Controlled fluoridation has been proved entirely safe.

"Fluoridation costs only a few cents per person per year.

"Virtually all scientific and professional health organizations with competence in the field . . . have urged the fluoridation of public water supplies. . . .

"The current progressive accumulation of dental decay is a heavy national burden. It is painful and costly. The means are readily available for preventing much of it. I therefore urge citizens in all communities served by public water supplies to con-

sider the facts about this important health measure. I believe that if all the facts are known, the great majority of people in all urban areas will conclude that their children and their children's children should not be denied the proved-health benefits of controlled fluoridation."

Right.

A gross disservice is being done the children of America by a small, militant, and for the most part, demagogic group which utilizes unscientific arguments to influence communities against fluoridation. All of the blame for the lag in fluoridation, however, must not be placed on the shoulders of the uninformed who, for various reasons, are opposed to it. Some of the blame must be shared by those of us who are informed, who have seen the evidence, who know the benefits, and who yet have not worked hard enough to bring about the adoption of this wholesome public health measure by our home communities.

The time has come when the proponents of fluoridation—the great army of dentists, physicians and public health workers—must become as aggressive in the promotion of the measure as the opponents have been in seeking its suppression. An informed community usually can be relied on to act wisely. It is up to the health professions in each community to see that their fellow citizens are kept fully informed so that they will act wisely on fluoridation.

Country prepares to take 1960 census—dentists asked to cooperate

Plans for taking the 1960 population census, according to the Bureau of the Census, U. S. Department of Commerce, are practically completed. Reproductions of more than four million square feet of maps are in the making for the use of the 160,000 census takers who will begin canvassing the country early in April.

One of the principal problems of the census bureau is keeping track of the boundary changes of various areas; hence the need of new, detailed maps of each zone for each enumerator. Another principal problem is the securing of accurate information on occupation. Every fourth household will be asked—concerning every person therein who is 14 years of age or older—"What kind of work does he do?"

In order that the occupational statistics on the dental profession be developed as accurately as possible it is requested that this question be answered completely and precisely. The Bureau of the Census furnishes some examples of acceptable entries: dentist, dental surgeon, oral surgeon, orthodontist, periodontist, pedodontist, prosthodontist, oral pathologist, public health dentist.

To these suggestions this column adds another: do not reply by answering "doctor." Used alone, the term "doctor" is ambiguous—as noninformative, as nondescriptive and as much of a problem to census takers as to everyone else—one which even the finest of census maps will not solve.

Dentistry will contribute to the 1960 White House Conference on Children and Youth

The White House Conference on Children and Youth has become, after a half century of observance, a national decennial custom. This year's conference which, at President Eisenhower's invitation, will be held in Washington, D. C., March 27 to April 2, promises to be greater in scope, objectives and—it is hoped—results than any that preceded it. For several months several thousand persons have been preparing the plans and laying the groundwork for the nation's sixth concerted effort to improve the health and welfare of children. The findings of the Conference and the recommendations of the conferees will be referred to an official national committee which, it is anticipated, will be appointed to follow through on the recommendations "to encourage and stimulate their implementation."

The dental profession will be ably represented by the Association at the 1960 Conference. This is well, as many of the 18 forum topics on the program, particularly those on nurture, human resources, population shifts, changes in health and living conditions and the physically handicapped are of specific concern to dentists.

Among the several substantial contributions that dentistry can make, through the medium of the Conference, to the nation's children is one which will stress the anticariogenic benefits that will accrue from the nationwide adoption of water fluoridation. Good dental health means so much to the growing child. Because of the increasing mobility of families in the United States, it is important that fluoridation be adopted as quickly as possible by all communities that have a public water system. Only in this way can the country assure those of its children who are moved by their families from city to city that they will continue to receive the benefits provided by fluoridation. Adoption by the 1960 White House Conference of a program to spread the benefits of fluoridation to all corners of the country would be a great contribution to the welfare and health of the more than 62,000,000 children and young adults in the United States.

Decennial White House conferences have increased greatly in scope, in interest and in attendance since President Theodore Roosevelt called the first in 1908 which was attended by 200 people. The outstanding result of that conference—one which has made a significant contribution to child health activities in the country—was the establishment of the Children's Bureau in the Department of Labor, since transferred to the Department of Health, Education and Welfare. Although the results of succeeding conferences have not, perhaps, been quite so far-reaching, the recommendations of each have made a marked contribution to the social and legislative protection of children and hence to the ideological progress of the nation.

Certainly those who assemble each ten years at the call of the President of the United States to give of their time, their talents and their financial resources to improve the time, the talents and the resources of the nation's children deserve the country's credit. The American dental profession, through the American Dental Association, welcomes the opportunity to contribute.

Midwest newspaper asks—and answers—an embarrassing question on advertising

Time was when the fourth estate would no more question the claims made for a product advertised in its columns than it would question the roundness of the earth. Not so many years back, a tooth paste manufacturer could cram so many claims for his product into its container that there was small room for the product itself. No matter how preposterous such claims might be, they passed, unscathed, the eyes of the editor provided an accompanying check passed, unscathed, the eye of the business manager.

Times have changed—and for the better. Each year the public press takes more seriously its public health responsibilities. Evidence of this awakening is found in many of the recent editorial comments concerning the wild assertions made for some of the country's more widely advertised dentifrices. Nor are all the editorial barbs directed at the promoters of the product. Some are aimed at those whose duty it is to protect the public from high-powered copy writers whose zeal often excels their scruples. *The St. Louis Post-Dispatch,* one of the nation's foremost newspapers, had this to say on the subject (December 19, 1959):

WHERE'S HIS LINE?

Chairman Earl W. Kintner of the Federal Trade Commission has put himself in the odd position of an inert object in the way of the American Dental Association's efforts to end misleading advertising claims for dentifrices.

More than a year ago the association and the FTC chairman started negotiations after hearings on the subject by the House Government Operations subcommittee headed by Representative John A. Blatnik of Minnesota. Nothing happened.

Now the association has made a new overture in its continuing effort to get something done. It proposes enactment of a law requiring dentifrice manufacturers to supply scientific proof of their advertising claims, instead of leaving the burden of proof on the FTC as it is now. The proposal is eminently sensible.

Chairman Kintner objects. "Where," he asks, "would you draw the line if you requested advance clearance of all ads?" If Chairman Kintner will make himself half as diligent about doing his job as he has been about arguing it cannot be done, he will find that drawing the line against deceit is not beyond the powers of a skilled and determined administrator.

news of dentistry

Legislation

JUSTICE DEPT. COMMENTS ON ACCREDITATION POLICY

A special insert has been placed inside the back cover of this issue of THE JOURNAL. The insert, numbered pages 231-234, presents information on a federal grand jury inquiry into certain aspects of relations between the dental profession and the dental laboratory group, a revision of Association policy on dental laboratory accreditation, and an evaluation of the revised policy statement by the United States Justice Department. JOURNAL readers are urged to study the report presented in the insert, as it contains information of great importance to the constituent dental societies which have approved or are considering the approval of programs for accrediting commercial dental laboratories.

EXPANSION EXPECTED OF SOCIAL SECURITY BENEFITS

Although Arthur Flemming, Secretary of Health, Education, and Welfare, has not yet suggested the "positive plan" for health care of the aged, which he announced before the end of last year he would recommend, it seems likely that there will be an expansion of benefits under the federal social security program.

President Eisenhower, in his State of the Union message to Congress, made no reference to any government-sponsored health benefit plans.

Meanwhile, Representative Aime J. Forand (D., R.I.), leading sponsor of legislation to provide health care benefits under OASI, stated that "our country's aged people are in need of such a program and the people are willing to pay for it."

BEAZLEY ASKS FOR REPORTS OF ABUSES OF F.T.C. RULES

In accordance with the resolution passed by the 1957 House of Delegates, reports of any apparent abuses of the amended Federal Trade Commission's *Trade Practice Rules for the Commercial Dental Laboratory Industry* should be reported to the Association by constituent societies, according to Bernard J. Beazley, secretary of the Council on Dental Trade and Laboratory Relations.

Mr. Beazley also calls attention to the 1957 resolution of the House of Delegates which states the Association's opposition "to the direct promotion to the public of any equipment, dental materials or any other product, the selection of which is exclusively the dentist's responsibility."

Information on any direct promotion to the public, or any abuse of the

amended F.T.C. rules should be sent directly to Mr. Beazley at the Central Office.

COUNCIL TO SEND BULLETIN ON RETIREMENT BILL

Informed sources in Washington have indicated that Senator Smathers (D., Fla.) will request a vote at an executive session of the Senate Finance Committee early in February on the self-employed retirement plan bill known as the Smathers-Morton-Keogh-Simpson bill. Senator Smathers is one of the leading proponents of the plan.

In view of this early vote, the Association's Council on Legislation is sending a bulletin to all members of the Association who reside in the states that have representation on the Senate Finance Committee, urging them to communicate with their senators and express their desire to have the bill passed.

TWO SENTENCED FOR UNLAWFUL DENTAL PRACTICE IN GEORGIA

Two Georgia laboratory operators, one in Atlanta and the other in Toccoa, were fined, and the Toccoa man was sentenced by a Superior Court judge to serve 60 days in jail for practicing dentistry without a license.

Mr. Jack Holcomb, a dental technician, was the defendant in the 1957 case testing the Georgia dental law that went to the Supreme Court. He recently returned to Toccoa and was becoming active again when the court stepped in with the contempt citation. He was fined $600 in addition to the jail sentence.

Mr. Luke Wells of Atlanta was fined $400 in the action brought against him by the State Board of Dental Examiners.

'DENTURISTS' IN WASHINGTON SEEK LICENSURE REFERENDUM

The Washington State Dental Association has reported that on January 11, a "so-called 'public denturist' group filed an initiative in Washington to place licensure of laboratory technicians on the state ballot."

This action represents a new approach by the so-called "denturists" who have been spectacularly unsuccessful in efforts to obtain licensure through the legislature in Washington and several other states.

Inquiry is pending and a report will be included in THE JOURNAL next month concerning, among other things, whether under Washington law the licensure question legally can be initiated by a group of citizens for a vote by the general electorate.

Association Affairs

CRUTTENDEN RETIRES: OTHER STAFF CHANGES ANNOUNCED

Louis M. Cruttenden, for 12 years assistant secretary of the Association, retired on December 31.

Dr. Cruttenden was graduated from the College of Dentistry, University of Minnesota, in 1916. He served in the Dental Corps of the Rainbow Division, U. S. Army, during World War 1, and then entered private practice, moving to St. Paul, Minnesota, in 1923. He was president of the St. Paul District Dental Society, and was secretary of the Minnesota State Dental Association for 16 years before moving to Chicago to serve as assistant secretary of the Association.

Dr. Cruttenden was made a member of the American College of Dentists in ceremonies held last September in New York.

Other Central Office staff changes, announced by Secretary Harold Hillenbrand, are as follows: Gerard J. Casey has been appointed secretary of the Council on Hospital Dental Service on a full-time basis; Mrs. Grace Parkin has been appointed secretary of the Council of the National Board of Dental Examiners on a

full-time basis; Mr. Herbert Jackman has been appointed director of the newly established Bureau of Audiovisual Service, and Miss Alice Panresis has been appointed executive assistant on the staff of the Council on Dental Education.

16TH CONGRESS ON DENTAL EDUCATION AND LICENSURE

The sixteenth Congress on Dental Education and Licensure will be held February 6 in the Williford Room of the Conrad Hilton Hotel, Chicago. The theme of the Congress will be "What Is the Role of Schools, Licensure Boards and Societies in Developing and Maintaining High Professional and Ethical Standards for Dental Practice?"

Panelists include Maynard K. Hine, Nelson L. Bossing, Ph.D., Carl A. Frech, Harold Hillenbrand, Francis J. Conley, and Harlan H. Horner, Pd.D.

Harvey S. Huxtable, chairman of the Association's Council on Dental Education, will moderate the morning session, and Leslie M. FitzGerald, Council vice-chairman, will moderate the afternoon session.

PATTON APPOINTED HONORARY DENTAL CONSULTANT TO NAVY

Charles H. Patton, president-elect of the American Dental Association, was recently appointed an honorary dental consultant to the Surgeon General of the Navy. Dr. Patton is a Diplomate of the American Board of Orthodontics, a member of the dental staff of Philadelphia General Hospital, and assistant professor of cleft palate therapy at the University of Pennsylvania School of Dentistry.

SHAILER PETERSON AGAIN OFFICER OF F. D. I. COMMISSION

Shailer Peterson, secretary of the Association's Council on Dental Education, was unanimously re-elected vice-president of the Commission on Dental Education of the Fédération Dentaire Internationale at its 47th Annual Session in New York.

TELEVISION SERIES PREPARED JOINTLY WITH BRITANNICA

Two television features on dental health, prepared jointly by the Association's Bureau of Public Information and Encyclopaedia Britannica, Inc., will be premiered on local television stations throughout the country during National Children's Dental Health Week, February 7-13.

The first feature, entitled "The Importance of your Smile," consists of 17 cartoons and a narrator's script. It runs approximately four minutes. The feature illustrates the effect of missing and decayed teeth, and of defective bite, on facial expression and the whole personality. It makes a strong appeal to preserve dental health from early childhood through adulthood by regular dental examinations.

The second feature, entitled "Baby's First Tooth," explains why deciduous teeth are important for the health and development of the permanent teeth. It makes parents aware of their responsibility as prime dental health teachers. The feature consists of 29 cartoons and a narrator's script and runs approximately five minutes.

Both features are designed to lead into an interview with a local dentist. Of 91 selected local television stations to which the features were offered, 46 have requested them to this date. Of these, 26 also requested the name of a local dentist for an interview. Although the features will be released during National Children's Dental Health Week, they are suitable for year-round use. They give credit to the American Dental Association by showing its seal at the beginning and end, and acknowledging the Association's cooperation in the development of artwork and script.

A third feature on the high cost of dental neglect is in preparation.

RELIEF FUND OVER THE TOP: SOME SOCIETIES WAY BEHIND

Although the American Dental Association Relief Fund was announced as over the 100 per cent mark at press time, the Council on Relief reported that there were still seven state societies and two federal services that had failed to contribute as much as 65 per cent of their quotas. These figures are based on the status of the fund as of December 31, 1959.

PROTECTIVE ASSOCIATION RECORDS GO INTO ARCHIVES

The Association's Bureau of Library and Indexing Service has been presented all of the principal records of the Dental Protective Association, to be placed in the archives. The records include minutes of the annual meetings, treasurer's reports, and a historical statement on the history of that association written by D. M. Gallie, president of the American Dental Association in 1914-1915.

The Dental Protective Association was formed in 1888 to protect dentists from costly and harassing patent litigation. Its duties were taken over by the American Dental Association in 1931 when action by the House of Delegates caused a process patent committee to be created.

In 1938 the Dental Protective Association became the John N. Crouse Dental Endowment Fund, named after the dentist who founded the association.

NEW BOOKLET ON FLUORIDE PUBLISHED BY BUREAU

"Fluoride Helps Prevent Tooth Decay" is the title of a new booklet published by the Association's Bureau of Dental Health Education.

The four-page leaflet discusses briefly fluoridation of public water supplies, topical application of stannous and sodium fluoride and the use of fluoride in tablet or other form. The leaflet points out that a dentist or a physician should supervise the taking of fluoride by an individual.

The new leaflet may be ordered from the Order Department. Prices are: (25) $0.50, (50) $0.90, (100) $1.60.

CHILDREN'S TELEVISION SHOW TO RUN DENTAL HEALTH FILM

Seventy-one "Romper Room" television programs throughout the United States will emphasize dental health during National Children's Dental Health Week, February 7-13.

The Association's Bureau of Dental Health Education is cooperating with Romper Room, Inc., by providing for each of its shows a four and one-half minute film, "Billy Meets Tommy Tooth," a toothbrushing poster and toothbrushes for all of the children.

The Bureau also has written to presidents of component dental societies in areas where Romper Room is shown, asking them to get in touch with the teachers in charge of the local programs. Each teacher would like to interview a dentist on the program and to have a dental unit set up in the studio, Mr. Perry J. Sandell, director of the Bureau, explained.

Dental Societies

SECRETARY BENSON TO SPEAK AT CHICAGO ANNUAL MEETING

Agriculture Secretary Ezra Taft Benson will be the principal speaker at the general session of the ninety-fifth annual Midwinter Meeting of the Chicago Dental Society. This meeting will be held on the evening of Monday, February 8.

The Horace Wells Anesthesia Award was presented at the annual meeting of the Horace Wells Club December 12 in Hartford, Conn., to Stevens J. Martin, M.D., chief anesthetist at St. Francis Hospital, Hartford. From the left, Dr. Martin, Philip Jones of Hartford, president; Dr. Albert Jacobs, president of Trinity College and guest speaker; Henry Hicks of Greenwich, who made the presentation.

During the Midwinter Meeting, which runs from February 7 through 10, the collection of gifts presented to the American Dental Association by nations and dental societies all over the world will be on display at the Conrad Hilton Hotel, headquarters for the meeting. These memorial plaques and works of art were presented to the Association last fall in New York in honor of its Centennial observance.

Also speaking at the general session Monday evening will be Paul Jeserich, president of the American Dental Association, and Harold H. Hayes, president of the Chicago Dental Society. The Men of Steel Chorus of the United States Steel Corporation will sing.

The nineteenth annual research award of the Chicago Dental Society will be presented to Robert J. Fitzgerald and Paul H. Keyes, Bethesda, Md. Their paper, on the demonstration of the etiologic role of oral streptococci in experimental caries, will be read at 11 A.M. Wednesday, February 10.

The sessions will close with a dinner dance Wednesday evening in the Grand Ballroom of the Conrad Hilton Hotel. Harry H. Kazen is general chairman of the Midwinter Meeting.

COLLINGSWOOD, N. J., DENTISTS DONATE TO INDONESIA SCHOOL

As a result of an appeal from a needy dental student of Sourabaya, Indonesia, who attends University Airlangga, a quantity of dental instruments and materials have been donated by the dentists of Collingswood, N. J., and are being packaged and shipped by the Collingswood Rotary Club.

Mr. Albert Sayre, president of the Collingswood Rotary Club, complimented the dentists for their generosity and support of this good will gesture.

"It is extremely gratifying," Mr. Sayre said, "to note that every dentist in Collingswood is donating instruments and supplies—in fact the response was so great that in addition to the materials requested, a shipment is being sent to the university so that other worthy but needy dental students will be benefited in their clinical studies."

Dentists of Collingswood are members of the Southern Dental Society of New Jersey.

The shipment is being packaged by a Collingswood Rotary committee consisting of President Sayre, Mr. Robert Dill, chairman, International Relations Committee, and F. R. van Istendal.

TIMMONS RECEIVES HONOR AWARD FROM RHODE ISLAND

Gerald D. Timmons, speaker of the American Dental Association's House of Delegates, received the Honor Award of the Rhode Island State Dental Society in ceremonies held January 16 in Providence. This was only the twenty-fifth time the award has been given since its inception in 1920.

Dr. Timmons, dean of the School of Dentistry of Temple University, is a past president and a former secretary-treasurer of the American Association of Dental Schools and past president of the American College of Dentists. He was awarded an honorary Doctor of Laws degree last fall by Fairleigh Dickinson University.

Professor Guido Fischer

International

GUIDO FISCHER DIES: WAS PIONEER IN ANESTHESIA

One of the pioneers in the field of dental local anesthesia, Professor Guido Fischer, died November 22, 1959, at Berg am Starnberg, Germany.

Professor Fischer was born in Dresden in 1877. He matriculated at the Berlin Institute in 1897 and became a student of Willoughby Dayton Miller, by whom he was greatly influenced. He was graduated in 1900 and continued his studies in the field of comparative dental anatomy. Four years later he received a Ph.D. degree while combining studies with dental practice. In 1907 he received a call to teach at the University of Greifswald and in 1911 he became a full professor. In the same year he was called to the University of Marburg to become dean of the dental school. His book on local anesthesia in dentistry appeared the same year. During the next few years he was invited to various parts of the world to lecture and give courses on local anesthesia. In this country he gave lectures at six dental schools and greatly influenced the development of the technic of injecting local anesthetic solutions in the oral cavity.

In 1921 he became dean of the dental school of the University of Hamburg. Curiously enough, he did not receive his dental degree (Dr.med.dent.) until two years later. In 1933 he retired to do research on the biology of the dental structures. In 1953 his book on the biology of the oral cavity appeared in two volumes.

Professor Fischer's book on local anesthesia went through ten German editions and four editions in English. He was an honorary member or corresponding member of more than 30 dental associations throughout the world.

NEXT F. D. I. WORLD DENTAL CONGRESS TO BE IN COLOGNE

The next world dental congress sponsored by the Fédération Dentaire Inter-

nationale will be held in Cologne, Germany, July 7-14, 1962. The organizing committee is well advanced with its plans for this important event. Chairman of the committee and president of the Congress is Erich Müller, an honorary member of the American Dental Association, and secretary general, Rolf Braun, Köln-Lindenthal, Universitätsstrasse 73, Germany.

The Congress will open at 10 A.M. Saturday, July 7 in the Cologne "Messe," a vast exhibition ground on the banks of the Rhine River. The Messe will provide accommodations for the scientific program, large dental trade show, the FDI business meetings of Assembly, Council and Commissions, and many of the social events. Restaurants, parking facilities and pleasant gardens are also to be found in the grounds.

A five day scientific program starting Monday, July 9, is being planned by the FDI Commission on Scientific Assembly. Each day one main theme will form the basis for lectures, discussions, table clinics and films. One day is to be devoted to basic research and its most recent developments. The main reports will be presented by invited speakers, but applications to give short papers, clinics, or to show films should be sent to the Secretary of the Commission, Professor C. H. Fischer, Homburg-Saar, Universitätskliniken, Germany.

Receptions, an organ concert, two balls, a banquet and an attractive program for the women are being planned. Dentists who intend to visit the Congress are advised to make hotel reservations at least 12 months in advance, as accommodations are likely to be difficult to get.

The forty-eighth annual meeting of the FDI will be held June 20-25 in Dublin.

FRITZ DRIAK DIES: WAS DEAN OF AUSTRIAN DENTISTRY

Professor Fritz Driak of Vienna died November 27 at the age of 60. The most outstanding dentist in Austria, Professor Driak had been director of the Dental Institute of the University of Vienna since 1945. He was president of the Association of Austrian Dentists and was responsible for the creation of the scientific section of that association.

Professor Driak was a member of the sub-Committee on the History of Dentistry of the Research Commission of the Fédération Dentaire Internationale, and was the Austrian delegate to the recent annual meeting of the FDI in New York.

A prolific writer, Professor Driak had contributed 136 articles to the dental literature. He was a surgeon before making dentistry his life work.

In view of Professor Driak's death, the International Dental Congress which was to take place September 28 to October 2 in Vienna has been cancelled.

Research

N.Y.U. DENTISTRY SCHOOL GETS $375,000 GRANT FOR RESEARCH

New York University's College of Dentistry has received a grant of $375,000 from the Murry and Leonie Guggenheim Foundation for continuing support of the Foundation's Institute for Dental Research.

Founded in 1954 under a grant of $500,000 from the Foundation, the Institute is one of the major centers for dental research in the United States. It is a part of New York University's Dental Center at First Avenue and 25th Street.

Research projects are currently under way in the following areas: age changes of oral tissues, dental caries, dental materials, oral cancer, oral growth and development, periodontal disease, saliva and salivary components, the calcified structures of the tooth, the dental pulp, x-ray defraction and electrophoresis.

National Defense

TYPES OF CARE RESTORED IN MEDICARE PROGRAM

The Office of the Surgeon General, U. S. Army, has announced that as of January 1, 1960, certain types of care that were deleted from the Dependents' Medical Care Program on October 1, 1958, have been restored. Of particular interest to the dental profession are the following:

Those surgical procedures that are legitimately cared for by a dentist (for example, cleft lip, cleft palate, and so forth) may be treated by a dentist who is a member of the staff of a hospital and normally performs these surgical procedures in that hospital. The removal of teeth, and gingivectomies and alveolectomies are not authorized procedures under the program unless they meet the criteria of adjunctive dental care as defined in this directive. When authorized surgical treatment is performed by a dentist, other procedures, diagnostic tests, services, and supplies authorized or ordered by him may be paid to the same extent as if a physician or surgeon authorized or ordered them under this directive.

Payments are authorized for the treatment of bodily injuries when a patient is not hospitalized, including diagnostic and therapeutic tests and procedures authorized by the attending physician, *but are limited* to treatment of fractures, dislocations, lacerations, and other wounds as prescribed in the local schedule of allowances. Treatment of fractures, dislocation, lacerations, and other wounds that are legitimately cared for by dentists, including related diagnostic and therapeutic tests and procedures authorized by the attending dentist, also may be paid for.

When a patient is treated for injury other than as an inpatient in a hospital, the payments made shall be in accordance with the local schedule of allowances. Payments not to exceed a maximum of $75, except as provided in paragraph 10d (ODMC Letter No. 12-59), are also authorized for laboratory tests, pathologic and roentgenographic examinations provided they are procedures performed by or authorized by the attending physician or surgeon. Payment of charges is also authorized for use of hospital outpatient facilities required for the treatment of the injury, for instance, for a cast room. The patient is responsible for payment of the first $15 of the physician's or dentist's charges for each different cause or accident for which treatment and services are rendered, except that multiple injuries to the same person resulting from a single accident will be considered as one injury for payment of the maximum fee ($15) by the patient. The government will pay for all costs in excess of $15, as authorized in the local schedules of allowances. However, payment by the government for laboratory tests, pathologic and roentgenographic examinations will not exceed the $75 maximum except as provided for under paragraph 10d.

A copy of ODMC Letter No. 12-59, which contains the complete data on restoration, can be obtained by writing to Robert W. Hobson, Lt. Colonel, DC, Director of Dental Affairs, Office for Dependents' Medical Care, Office of the Surgeon General, U. S. Army, Washington 25, D. C.

Bronze plaque which was unveiled recently when an Army Dental Clinic was dedicated to the memory of Maj. Marvin W. Carius, an Army dentist killed nine years ago in Korea. The modern dental clinic is located on the Yongsan Military Reservation in Seoul, Korea.

MARVIN W. CARIUS DENTAL CLINIC DEDICATED IN KOREA

An Army dental clinic in Seoul, Korea, has been dedicated to the memory of Maj. Marvin W. Carius, an Army dentist killed nine years ago, during an ambush by North Korean guerrillas near Singye, North Korea. Major Carius was Dental

Surgeon of the 24th Infantry Division when his convoy was ambushed. He died December 9, 1950.

The Bronze Star Medal for meritorious service in Korea was awarded posthumously, and was presented to his widow, Mrs. Geraldine Carius of Morton, Ill., in January 1952.

Major Carius was graduated from the University of Illinois School of Dentistry in 1946 and was appointed First Lieutenant, Regular Army, in the Army Dental Corps in 1947.

A bronze plaque citing Major Carius was unveiled at the dedication ceremony. The new dental clinic, located on the Yongsan Military Reservation in Seoul, is equipped with the most modern dental equipment and will make possible the provision of the highest quality of dental care to the United States troops serving in that area.

CASUALTY TREATMENT COURSE SCHEDULED IN NORFOLK, VA.

A Casualty Treatment Training Course is scheduled for presentation at the United States Naval Dental Clinic, Naval Base, Norfolk, Virginia, from May 9 to 13. Association members interested in attending are asked to contact the Council on Federal Dental Services at the Central Office.

ARMED FORCES DENTISTS IN KOREA FORM NEW SOCIETY

More than 100 charter members and guests recently attended the first meeting of the 38th Parallel Dental Society, a new organization of United States Armed Forces dentists serving in Korea.

Col. Leo C. Sexauer, DC, Dental Surgeon, opened the meeting which was held at United Nations Command Headquarters in Seoul. The featured guest speaker, Col. Roy L. Bodine, Jr., DC, Dental Surgeon, U. S. Army, Fort Kamehameha, Hawaii, spoke on "A Sound, Complete Denture Technic for the General or Military Dentist." Lt. Col. Charles C. Alling, DC, Oral Surgery Consultant, Eighth U. S. Army, also spoke. Colonel Alling is the president of the 38th Parallel Dental Society.

The 38th Parallel Dental Society, a new organization of United States Armed Forces dentists serving in Korea, held its first meeting at United Nations Command headquarters in Seoul. The new group has 83 charter members.

The new society is composed of 83 charter members, and plans to meet ten times a year. Any U. S. Armed Forces dentist in Korea is eligible for membership, and all dentists, military and civilian, are invited to attend the meetings.

Dental Education

DENTAL EDUCATION COUNCIL APPROVES HOSPITAL PROGRAMS

At the December meeting of the Association's Council on Dental Education the following 18 dental internship and residency programs were approved:

King County Hospital, Seattle, Wash., oral surgery residency (24 months); Harrisburg Hospital, Harrisburg, Pa., oral surgery residency (12 months); United States Naval Hospital, Philadelphia, oral surgery residency (second year); Veterans Administration Hospital, 408 First Avenue, New York, oral surgery residency (second year); Ohio Valley General Hospital, Wheeling, W. Va., oral surgery residency (second year); Veterans Administration Hospital, Philadelphia, rotating dental internship; Womack Army Hospital, Fort Bragg, N. C., rotating dental internship; Veterans Administration Hospital, Brockton, Mass., rotating dental internship; United States Army Hospital, Fort Benning, Ga., rotating dental internship; St. Francis Hospital, Hartford, Conn., oral surgery residency (12 months); Milwaukee Children's Hospital, Milwaukee, pedodontic residency (second year); Michael Reese Hospital, Chicago, rotating dental internship; United States Naval Hospital, Oakland, Calif., oral surgery residency (second year); United States Naval Hospital, Great Lakes, Ill., oral surgery residency (second year); Veterans Administration Hospital, Kansas City, Mo., oral surgery residency (24 months); National Institutes of Health, Bethesda, Md., oral pathology residency (24 months); Milwaukee County Hospital, Milwaukee, oral surgery internship, and Illinois Research and Educational Hospital, Chicago, oral surgery internship and oral surgery residency (12 months).

Dental graduates and senior dental students who are interested in applying for internship and residency appointments should write to the Chief of Dental Service at the hospital offering the program in which they are interested, requesting information concerning admission requirements and application procedures.

A complete list of internship and residency programs approved by the Council on Dental Education is currently being prepared and will be available on request after March 1.

'TOTAL PATIENT CARE' AIM OF PENNSYLVANIA DENTAL SCHOOL

The University of Pennsylvania School of Dentistry announces the appointment to its staff of Regina F. Flesch, Ph.D. Dr. Flesch's professional experience is in psychiatric social work. Her doctoral research, "An Exploratory Study of the Dental Student's Concept of the Dental Patient," was carried out at the University of Pennsylvania and has stimulated interest in closer study of the relationships between student-dentists and patients.

Dr. Flesch will consult with the students on problems that arise in their relationships with clinic patients. She will also work with faculty members and students to develop case histories for teaching purposes, illustrating the supplementation of dental treatment by interviews.

Ultimately, the school plans to integrate into its dental education program social science concepts relevant to dental practice, and also plans to have its own social service division so that students may develop better understanding of "total patient care."

GRADUATE ORTHODONTICS AT U. OF SOUTHERN CALIF.

The University of Southern California announces that the program in graduate orthodontics in the School of Dentistry will be resumed with the beginning of the school year in September 1960. The course extends over two academic years and the intervening summer (21 months) and leads to a Master's Degree.

Sheldon W. Rosenstein, formerly of the orthodontics faculty of Northwestern University, will direct the program. Dr. Rosenstein received both his D.D.S. and M.D.Sc. degrees from Northwestern.

Further information can be obtained from the office of admissions of the school at 925 West 34th St., Los Angeles 7.

RESIDENCY AND INTERNSHIP AVAILABLE IN PITTSBURGH

The Veterans Administration Hospital, Leech Farm Road, Pittsburgh 6, announces that it is accepting applications for its one-year rotating dental internship program which begins July 1, 1960 and its two-year prosthodontics residency program, which also begins on that date.

The Veterans Administration Hospital Dental Service is approved by the American Dental Association's Councils on Dental Education and Hospital Dental Service.

Further information can be obtained by writing to the chief of dental service at the hospital.

TWO-YEAR PROGRAM IN PEDODONTICS AT BAYLOR

Applications for a new graduate program in pedodontics are being invited by the Baylor University College of Dentistry in affiliation with the Children's Medical Center, Dallas, Texas. The classes will begin in September 1960.

The program is a two-year full-time course utilizing both the facilities of Baylor University and those of the Children's Medical Center. The degree of Master of Science in Dentistry will be awarded on successful completion of the requirements. The Children's Medical Center provides tuition and other university fees and a stipend of $150 per month plus room and meals for two students.

Applications and further information can be obtained by writing to: Dr. John J. Murray, Jr., chairman, Department of Pedodontics, Baylor University College of Dentistry, 800 Hall St., Dallas.

UNIVERSITY OF ILLINOIS ORAL SURGERY COURSES

The College of Dentistry of the University of Illinois is accepting applications for two and three year full-time courses in oral surgery beginning in July. Both programs carry credit toward a Master of Science degree.

Further information can be obtained from Daniel M. Laskin, department of oral and maxillofacial surgery, University of Illinois, 808 S. Wood St., Chicago 12.

POSTGRADUATE COURSES DEAL WITH VARIED SUBJECT MATTER

Alabama • William L. McCracken will present a refresher course on complete denture prosthesis March 4-6 at the University of Alabama School of Dentistry.

Courses to be given in May are pedodontics for the general practitioner, May 7 and 8, Sidney B. Finn; root canal therapy followed by apicoectomy, May 11-13, Adeeb E. Thomas; anatomy of the head and neck, May 23-25, Harry Sicher, M.D.; hypnosis applied to dentistry, May 27-29, William T. Heron, Ph.D.

Further information can be obtained from the director, refresher course program, University of Alabama School of Dentistry, 1919 7th Ave. S. Birmingham.

Albert Einstein College of Medicine • The Albert Einstein College of Medicine, Department of Dentistry, will sponsor a ten session postgraduate course in periodontics every Wednesday starting March 2. The lecture sessions will be held at the College and the clinical demonstrations at the dental clinic of

Jacobi Hospital. Application forms can be obtained by writing to the director of postgraduate studies at the college. The address is Eastchester Road and Morris Park Ave., New York 61.

Albert Einstein Medical Center • Dentistry for the handicapped child will be taught by Morris Kelner and associates April 25-27 at the Albert Einstein Medical Center, Northern Division, Philadelphia. The fee is $100 and registration will be limited to ten students. Registration closes April 10.

California • The University of California School of Dentistry is offering a workshop on the psychology of loss of teeth and its relation to the patient, Friday and Saturday, February 5 and 6. Guest lecturer will be Harvey A. Lewis, M.D. A course on the newer concepts in periodontal therapy will be given by Henry Goldman February 19 and 20. The school is located at Third and Parnassus Avenues, San Francisco 22.

Illinois • Three courses are offered in March by the University of Illinois College of Dentistry and one in May. They are: dentistry for children, designed for general practitioners, March 14-18, Thomas K. Barber; dentistry for the handicapped child, March 21-24, Thomas K. Barber; a workshop on the teaching of radiology in dentistry, March 18 and 19, presented in cooperation with the American Academy of Oral Roentgenology and the W. K. Kellogg Foundation (moderators will be Seymour Yale and Donald T. Waggner); periodontics in general practice, May 4 and 5, Charles G. Maurice. Further information can be obtained by writing to the Division of Postgraduate Education, University of Illinois College of Dentistry, 808 S. Wood St., Chicago 12.

Lancaster Cleft Palate Clinic • The Lancaster Cleft Palate Clinic offers a seminar April 4-7 in diagnosis, research and treatment of individuals with oral-facial-speech handicaps. Applications are available to the dental, medical and speech professions, by writing to M. Mazaheri, chief, Dental Services, Lancaster Cleft Palate Clinic, 24 North Lime St., Lancaster, Pa.

New York • New York University's College of Dentistry offers the following short-term postgraduate courses beginning in February: periodontics and oral medicine, Wednesdays beginning February 3 through April 6, Sidney Sorrin and associates; complete denture prosthesis, Wednesdays, February 17 through June 1, Sidney I. Silverman and associates; partial dentures, Fridays, February 19 through May 20, Sidney I. Silverman and associates; endodontics, Wednesdays and Fridays, February 26 through March 30, Morris B. Auerbach and associates.

The same school offers the following courses beginning in March; Spanish-language course in periodontics and oral medicine, March 2-25, Sidney Sorrin and associates; Spanish-language course in periodontics and oral medicine, March 2-May 27, Sidney Sorrin and associates; internal medicine with application to dentistry and oral surgery, March 9 through May 28, Adolph R. Berger and staff; technic of exodontics and relation of oral surgery to prosthodontics, March 9 through May 28, Irving Salman; oral tumors, March 9 through May 28, Frank S. Butler; maxillofacial injuries, March 9 through May 28, William F. Harrigan; pain syndromes of the face, March 9 through May 28, Clyde B. Kayne; pathology, March 9 through May 28, Vincent S. Palladino and Leslie I. Lukash; high-speed instrumentation, Fridays, March 11 through June 3, Arthur H. Morrison and staff; elastic impression technics, Fridays, March 11 through April 15, Arthur H. Morrison and staff; immediate dentures, Fridays, March 11 through May 6, Sidney I. Silverman and George A. Buckley.

Further information on any of the courses can be obtained by writing to the director of the Postgraduate Division, College of Dentistry, New York University, 421 First Ave., New York 10.

Pennsylvania • The School of Dentistry at the University of Pennsylvania lists the following courses: practice administration, March 7 and 8, Harry M. Klenda; practical and simplified procedures in crown and bridge prosthesis, March 14-18, Charles B. Sceia; extraoral tracers in rehabilitation of function, March 21-23, Ernest R. Granger; pulp reactions to operative procedures, March 25 and 26, Samuel Seltzer, I. B. Bender and Louis I. Grossman; complete denture prosthesis, March 28-31, Vincent R. Trapozzano; endodontics, March 28-April 8, Louis I. Grossman; applied anatomy, April 20-22, Harry Sicher, M.D.

Puerto Rico • The University of Puerto Rico School of Dentistry is sponsoring a postgraduate course in crown and bridge prosthesis April 25-29. It will be under the direction of John F. Johnston and the fee is $50. Applications can be sent to Rafael Aponte, Jr., Director, Postgraduate Education, School of Dentistry, University of Puerto Rico, San Juan 22, Puerto Rico.

Seton Hall • A postgraduate course for orthodontists will be given March 27-30, with spe-

cial emphasis on the edgewise arch mechanism in extraction cases under the direction of Harry Bull. The address is Seton Hall College of Dentistry, The Medical Center, Jersey City 4, N. J.

Temple • Four courses are offered by the Temple University School of Dentistry. They are: clinical diagnosis and oral medicine, February 29-March 4, Lester W. Burket and S. Leonard Rosenthal; electronic electrosurgery, March 18 and 19, Maurice J. Oringer; complete denture prosthesis, March 21-26, Bernard Jankelson and associates; advanced surgical technics in periodontal therapy, April 4-9, Saul Schluger and Jack Alloy.

Tufts • The School of Dental Medicine of Tufts University will present a course in hypnosis and its clinical applications March 17-23, for dentists, physicians and psychologists. The director of the course is Lawrence Milton Staples.

Washington • The University of Washington School of Dentistry will present a refresher course in dental ceramics March 17-19 with William H. Hagen instructing. Enrollment will be limited to eight participants and the fee is $135.

INTERNSHIPS, RESIDENCIES, FELLOWSHIPS AVAILABLE

Eastman Dental Dispensary, Rochester, New York, offers 20 internships, designed to give preparation for general practice and running from September to June. These carry remuneration at the rate of $50 per week. Two appointments also provide hospital residence.

An extensive clinically related lecture and seminar program is offered and opportunity is given to initiate laboratory or clinical research.

On completion of the internship program, selected candidates may enter programs of specialty training in pedodontics, periodontics, orthodontics, oral surgery or research, which may, under some circumstances, be combined with the earning of a Master of Science degree from the University of Rochester. Inquiries can be addressed to Basil G. Bibby, director, Eastman Dental Dispensary, Rochester 3, New York.

Emory University is offering two 24-month teaching fellowships in orthodontics in which participants engage in a program of guided study, research, and practice which establishes a solid background for beginning the practice of the specialty. Fellows receive an annual stipend of $1,200. Appointments are made each year to begin July 1 for the succeeding 24-month period. Further information can be obtained from Frank F. Lamons, professor of orthodontics.

A similar graduate teaching fellowship in periodontics is offered at Emory to begin August 1. Additional information on this fellowship can be obtained from Ernest L. Banks, professor of periodontology. For a fellowship in prosthetic dentistry, also to begin August 1, information can be had by writing to Lynn C. Dirksen, professor of prosthetic dentistry.

In cooperation with the Emory University Schools of Dentistry and Medicine, approved two-year residencies in oral surgery are available at the Atlanta Veterans Administration Hospital and Grady Memorial Hospital. These residencies are approved by the Council on Dental Education of the American Dental Association, and are recognized and accepted toward the partial fulfillment of American Board of Oral Surgery requirements. Further information can be obtained from H. J. Harpole, professor of oral surgery.

The address of the university is 106 Forrest Ave., N.E., Atlanta 3, Ga.

Medical College of Virginia, School of Dentistry, Richmond, offers fellowships for graduate study. The fellowships, made available through a teachers' training grant from the National Institute of Dental Research, provide annual stipends of $5,000. Individuals receiving fellowships may work toward M.S. or Ph.D. degrees in basic science departments of the Medical College of Virginia. Information on the program can be obtained from the director of graduate and postgraduate instruction, H. T. Knighton.

General

DENTAL INSTRUMENTS ADDED TO SMITHSONIAN COLLECTION

Mr. Frank A. Taylor, director of the Museum of History and Technology, Smithsonian Institution, recently acknowledged the receipt of an ultrasonic dental cutting instrument and a dental air turbine handpiece from Capt. E. G. F. Pollard, DC, USN, Commanding Officer, U. S. Naval Dental School, National Naval Medical Center, Bethesda, Md. It

is the intent of the United States National Museum to add these instruments to its collection on the history of dentistry.

The air turbine handpiece was developed in the U. S. Navy by Mr. Paul Tanner and Chief Dental Technician Oscar Nagel, USN, under the supervision of Rear Admiral C. W. Schantz.

Research on the handpiece began in 1954 when Admiral Schantz was Commanding Officer of the Naval Dental School. Under his guidance, it was perfected in 1956. In that year, under a license from the Office of Naval Research, the handpiece was offered to the profession by The Weber Dental Manufacturing Company.

The original model of the handpiece in the Smithsonian Institution takes its honored place with other dental instruments of historical interest, from which progress in dentistry can be studied. The key, pelican, the finger drill, the palm drill, the hand drill, the Dr. Black foot drill (the first cord arm type), the hand-held electric dental engine, the dental engine—all presage the continuous and continuing battle against pain in the dental office.

When the doors of the new Smithsonian Institution building open in 1962, the role of dentistry will be portrayed even more extensively than is presently possible.

SOGNNAES WRITES ON FUTURE OF DENTISTRY FOR 'SCIENCE'

"Dentistry at its Centennial Crossroads" is the title of an article by Reidar F. Sognnaes which appeared in the December 18, 1959, issue of *Science*.

In the article Dr. Sognnaes outlines some of the achievements of dentistry

Formal presentation was recently made of an ultrasonic dental cutting instrument and a dental air turbine handpiece to the Smithsonian Institution. Seen, from left to right, are Mr. Frank A. Taylor, director, Museum of History and Technology, Smithsonian Institution; Rear Admiral C. W. Schantz, DC, USN, Assistant Chief of the Bureau of Medicine, and Surgery (Dentistry) and Chief, Dental Division; Captain E. G. F. Pollard, DC, USN, Commanding Officer, U. S. Naval Dental School.

in the past century and indicates where the profession's future challenge may lie. He is acting dean and professor of oral pathology at the Harvard School of Dental Medicine, past president of the International Association for Dental Research and present secretary of the American Association for the Advancement of Science's Section on Dentistry.

Americans invest more than one and a half billion dollars per year in the care of their teeth, about one-sixth of the nation's total expenditure for health. In view of the fact that only a small percentage of that total is invested in basic dental research, Dr. Sognnaes stated that he thought three things must be seriously considered if the dental health problem is to be resolved in the century ahead. He wrote:

"Step number one is to implement the research training for dental scientists. This requires substantial long-term support. To get this under way the federal government must step in with support specifically earmarked for the training of dental researchers until dental schools come to attract a greater share in endowments by private foundations.

"Step number two is to enable properly trained dental scientists to pursue basic research on a long-term basis rather than be confined to narrow, short-term projects.

"Step number three is for this new breed of dental scholar and investigator to extend and deepen his collaboration with scientists and experts in other fields, ranging from laboratory research to 'chairside' and bedside patient care.

"Ultimately," Dr. Sognnaes concludes, "this three-pronged approach will elevate the whole triad of teaching, research and service for dental health."

EASTER SEALS AID TREATMENT OF CRIPPLED CHILDREN

The 1960 Easter Seal campaign, sponsored by the National Society for Crippled Children and Adults, will open March 17 and continue through April 17, Easter Sunday.

Funds raised in this campaign are used to supply continuing and expanded care and treatment to crippled children and adults. Accidents and other crippling conditions are constantly adding new names to the list of those requiring care and treatment, the benefits of study and research, the opportunities for rehabilitation and ultimate independence.

Last year more than 250,000 crippled boys and girls, men and women in all 50 states were served by Easter Seals.

NEW FORMAT FOR DENTAL ASSISTANTS' JOURNAL

The Dental Assistant, journal of the American Dental Assistants Association, appears for the January-February period of 1960 in redesigned form with a distinctive change in the cover. The new format is the result of action taken at the Dallas meeting of the association in 1958 when a publications committee was formed, and the result of a readership survey which was done in 1959.

The newly designed magazine has been enlarged slightly and now conforms to the page size of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

OHIO STATE DENTAL SCHOOL PLANS POSTCOLLEGE ASSEMBLY

The sixteenth annual postcollege Assembly of the College of Dentistry, Ohio State University, will be held Wednesday and Thursday, April 20 and 21. The Assembly will feature a discussion of the early detection of oral cancer from both the dental and medical aspects, a practical evaluation of the newer dental materials, a television clinic program, and demonstration table clinics. There also will be an opportunity to inspect the new addition to the College of Dentistry building.

DEAN BURKET ON COMMISSION TO STUDY HEALTH HAZARDS

Lester W. Burket, dean of the University of Pennsylvania School of Dentistry, has been appointed to a special international commission to study the occupational health hazards of dentists all over the world.

Dr. Burket will represent the American Dental Association on the Commission which was created by the General Assembly of the Fédération Dentaire Internationale at its recent annual meeting in New York.

Other professional dental groups represented on the Commission include the British Dental Association and the French, German and Swedish national dental committees.

In addition to the study of occupational health hazards, the Commission also will investigate the relationship of health hazards to the income of dentists, with particular attention to the age factor, and further will study the relationship of the dentist to society as a whole.

Dean Burket is first vice-president of the American Association of Dental Schools.

CHICAGO UNIVERSITY PRESS PUBLISHES RESEARCH JOURNAL

Beginning January 1 of this year, the University of Chicago Press has been publishing the *Journal of Dental Research*. The C. V. Mosby Company of St. Louis formerly was publisher of the magazine.

USS HOPE, HOSPITAL SHIP, TO SAIL ON MERCY MISSION

A seven-man dental team will be part of the medical crew aboard the Navy hospital ship USS Consolation, to be renamed the USS Hope, when it sails in the spring on a privately financed goodwill health mission to Southeast Asia.

Plans for the dental profession's contribution to the mission were described by Lester W. Burket, chairman of the dental curriculum committee for the project.

Dr. Burket, who also is chairman of the Association's Council on Dental Therapeutics, said the dental team will consist of:

Two practicing dentists, one an oral surgeon and one a general practitioner; one public health dentist; a hygienist; a laboratory technician, and two chairside assistants.

Dr. Burket suggested that members of the dental profession interested in the project contact William B. Walsh, M.D., Washington, D. C., president of the People to People Health Foundation which is sponsoring the project.

The floating medical center will go only to countries whose health professions extend an invitation. Major dental work will be performed on the ship in a modern center equipped to employ latest technics of the profession.

The poster shown above will be carried on the sides of thousands of linen supply delivery trucks during April, the Linen Supply Association of America, Chicago, has announced. Members of the association, in cities throughout the nation, voluntarily support public service causes through posters placed on their delivery trucks.

NEW OFFICERS, BOARD MEMBERS OF PROSTHODONTICS BOARD

Daniel H. Gehl of Milwaukee is the new president of the American Board of Pros-

thodontics. Other newly-elected officers are:

Vice-president, Raymond J. Nagle, dean, New York University College of Dentistry; secretary-treasurer, Charles H. Jamieson, Detroit; board members (re-elected for three year terms), Bertram H. Downs, Colorado Springs, Colo., and A. H. Grunewald, Chicago, and new members of the board, Gilbert P. Smith, New York, and Jack Werner, San Francisco.

The 1960 annual meeting of the Board of Prosthodontics will be held July 25-30 in Washington, D. C.

L. E. BLAUCH AFFILIATES WITH RETIRED PROFESSORS REGISTRY

Lloyd E. Blauch, Ph.D., formerly assistant commissioner and director of the Division of Higher Education, Office of Education, Department of Health, Education, and Welfare, has retired from that position and is now assistant director of the Retired Professors Registry.

Members of the dental profession and of dental school faculties will remember Dr. Blauch as executive secretary, Curriculum Survey Committee, American Association of Dental Schools (1931-35). He wrote the reports of the committee entitled "A Course of Study in Dentistry," and later, "Teaching in Colleges and Universities with Special Reference to Dentistry."

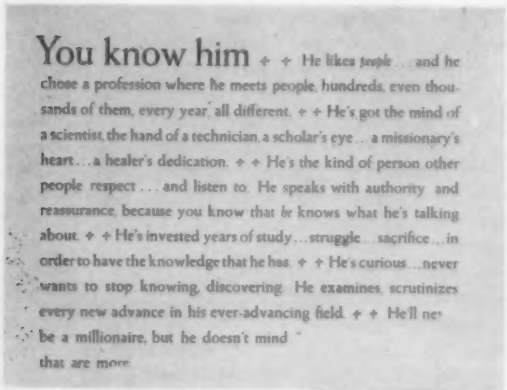
The Retired Professors Registry serves as a national register for retired college and university faculty members and administrators who desire to be considered for academic positions in institutions other than those from which they have retired. It is supported by a grant from the Ford Foundation.

SURVEY COMMISSION MEMBER H. W. PRENTIS, JR., DIES

Word has been received of the death October 29, 1959, of Mr. Henning W. Prentis, Jr., of Lancaster, Pa. Mr. Prentis, an official of the Armstrong Cork Company, was a member of the Commission on the Survey of Dentistry in the United States.

AWARD PROGRAM ESTABLISHED BY COLUMBIA DENTOFORM CORP.

In honor of the Centennial Celebration of the American Dental Association, the Columbia Dentoform Corporation of New York proposed to the American Association of Dental Schools the establishment of an annual award program for the best published articles on dental teaching. The schools association accepted the proposal in principle and now


You know him + + He likes people . . . and he chose a profession where he meets people, hundreds, even thousands of them, every year, all different. + + He's got the mind of a scientist, the hand of a technician, a scholar's eye . . . a missionary's heart . . . a healer's dedication. + + He's the kind of person other people respect . . . and listen to. He speaks with authority and reassurance, because you know that *he* knows what he's talking about. + + He's invested years of study . . . struggle . . . sacrifice . . . in order to have the knowledge that he has. + + He's curious . . . never wants to stop knowing, discovering. He examines, scrutinizes every new advance in his ever-advancing field. + + He'll ne[ver] be a millionaire, but he doesn't mind [the things] that are more

This is a portion of the printed testimonial to America's dentists which has been distributed by the Bristol-Myers Products Division to dentists throughout the United States. The reprint is on heavy paper and is suitable for framing.

announces that negotiations were recently completed with Columbia Dentoform regarding some of the major terms of operation.

The program will be administered by the editor and editorial board of the *Journal of Dental Education*. First awards will be presented this year and $1,000 in prizes will be given annually.

MORE EXAMINATION DATES SET BY LABORATORY BOARD

The National Board for Certification of the National Association of Dental Laboratories has announced the following dates for examinations for certificates for laboratory technicians:

Chicago, February 6; Los Angeles, February 20; San Francisco, February 27; Boston, March 5; Pittsburgh, March 19; Atlanta, March 26, and Detroit, April 2.

ILLINOIS U. DENTAL ALUMNI TO HOLD ANNUAL LUNCHEON

The University of Illinois Dental Alumni Association will hold its annual luncheon Wednesday, February 10, during the Chicago Dental Society's Midwinter Meeting.

The luncheon will be in the Beverly Room of the Conrad Hilton Hotel at noon and special tables will be reserved for class reunions.

Again this year, Room 556A of the hotel will be the hospitality room and will be open throughout the meeting. Everett G. Walters, Oak Park, is chairman of the hospitality room.

ORAL PATHOLOGY ACADEMY TO MEET IN CHICAGO APRIL 27-29

The American Academy of Oral Pathology will hold its fourteenth annual meeting at Northwestern University, Chicago, April 27-29. The examination for elevation to Fellowship in the Academy will be given on April 27. Information can be obtained from Robert J. Gorlin, secretary, University of Minnesota School of Dentistry, Minneapolis.

A CORRECTION

In the story in the December issue announcing that *Dental Abstracts* was beginning its fifth year of publication, the subscription rate listed was in error. The annual rate is $8 a year in the United States and $9 to subscribers outside the United States. Request for subscriptions can be sent to the Subscription Department, American Dental Association, 222 E. Superior St., Chicago 11.

Also • Bernerd C. Kingsbury, San Francisco, past president of the Association, has been appointed Honorary Civilian Consultant to the Surgeon General of the Navy. . . . Robert Gorlin, Minneapolis, was elected 1960 dental chairman of the Coordinators of Cancer Teaching. Dr. Gorlin is professor and chairman of oral pathology, University of Minnesota. . . . Harry Lane Robinson, assistant clinical professor at New York University's College of Dentistry for the past two years, has been named professor and chairman of the department of pathology. . . . Sidney Weiss has been appointed group leader in the Colgate-Palmolive Laboratory for Dental Medicine Research, located on the Rutgers University Science Campus. . . . The official song for Miami's Orange Bowl Queen was written by a dentist, Norman R. Alley of South Miami.

the reader comments

THE JOURNAL *devotes this section to comment by readers on topics of current interest to dentistry. The editor reserves the right to edit all communications to fit available space and requires that all letters be signed. At the request of the author, signatures will be deleted before publication. Printed communications do not necessarily reflect the opinion or official policy of the Association. Your participation in this section is invited.* *The Editor*

'STILLBORN' DENTAL HOSPITAL

I write this with emotions of dismay and dejection as a dentist who is and always has been closely allied with hospital practice.

I have watched the Southern California Dental Hospital grow and mature with avid interest. This week I read of its impending demise in *Time* magazine (Dec. 28). Although the *Time* article contained several inaccuracies and did not paint an attractive picture of dentistry, the bald truth is outlined cogently: "professionally conservative dentists" have not admitted more than a half-dozen patients a week to this exquisite but stillborn institution.

As a dentist who has spent his entire professional life actively interested in the relationship of our profession with the general hospital, I view the repudiation of the California institution with perplexed disappointment.

One possible cause of the failure may be that the Southern California Dental Hospital is a proprietary private hospital. Generally, one does not associate this type of institution with the best patient care and therapy. Usually we think of teaching institutions and voluntary nonprofit hospitals as being the locations at which the most advanced and comprehensive philosophies are practiced.

The number of patients admitted to the dental services of the general hospitals of Los Angeles number 5,000 each year. If these patients were diverted to the dentists' hospital, success would be a reality. This is not the case.

Is it possible that the existence of such a specialty hospital is not acceptable to the dentists who have been admitting regularly? Perhaps the bases upon which their practices are set depend on a general hospital affiliation. If this is so, the new hospital requires the attention of a virtually untapped resource —the vast rank and file of general practitioners. In New York City today, one is hard put to find a surgeon who will do as little as the removal of a sebaceous cyst in the office. These are operating room cases, sometimes even on an inpatient basis. The effect is to create a broader aura of safety for the patient and to erect in his mind an impression that he has been subjected to an important procedure performed by a prestigious surgeon.

We, on the other hand, because of the historical medico-dental dichotomy, have been trained to perform major surgery in our office. However, if we want to achieve the well-deserved parity with our physician associates, many of whom have far less complicated or serious practices than our own, we must create in the eyes of the public a more imposing picture of the dental practitioner.

A proprietary specialty hospital may not have been the answer, but surely such a beautifully planned and executed institution as the Southern California Dental Hospital should not be permitted to fall into the hands of some minor surgical specialty. I make this special plea to my West Coast colleagues. Create in Los Angeles the beginning of an era. A genesis of a new philosophy of total patient care in which dental medicine takes its equal and rightful place in the health team.

A. Norman Cranin, D.D.S.
2120 Ocean Avenue
Brooklyn 29, New York

international correspondence

News from Brazil

JOURNAL OF THE UNIÃO ODONTOLÓGICA BRASILEIRA

The Brazilian national dental association (UOB), which corresponds to the American Dental Association, started publishing its own journal in January. The edition of 10,000 at first will be bimonthly, later monthly. All editorials are examined by the UOB and published under its direct responsibility. The scientific articles are chosen by a special committee. Professor Alfredo Reis Viegas, president of the UOB, is director of the journal, called *Revista da União Odontológica Brasileira.*

ABENO

ABENO (Associação Brasileira de Ensino Odontológico) is an association created in August 1956 to promote improvements in Brazilian methods of teaching dentistry. It works in close cooperation with CAPES, the National Campaign for Improvement of University Personnel, with the United States International Cooperation Administration, Point 4 Program, and with the Special Public Health Service.

ABENO is dedicated to improve the relationship between the different universities and its staff, to complete the dental education of that personnel and to prepare new students for a university career. During 1957 ABENO sponsored eight national scholarships, and in 1958 ten were sponsored. Scholarships to schools outside of Brazil were sponsored by the ICA-Point 4 Program.

In 1957 ABENO financed the courses given by Emanuel Cheraskin of the University of Alabama. These constituted 150 hours of classes at the School of Dentistry, University of São Paulo. Two other courses were also financed: one on biostatistics by Guilherme Arbenz, and one on oral cancer by João Fairbanks Barbosa. The next year the following courses were given: technic of bibliographic research in dentistry, by the librarian, Mrs. Terezine Arantes Ferraz; high speed in cavity preparation, by Celso Lima Pereira; endodontics, by Professor Paulino Guimarães, Jr., and oral surgery, by João Jorge Barros.

During July 1958 ABENO held its second meeting in Natal. All dental schools, 33 at that date, were represented. Three main themes were debated: selection of students who seek to enter dental schools; training of teachers, and the teaching programs of the universities.

One of the most ambitious projects of ABENO is to make a complete study of the various Brazilian dental schools, which is now taking place. Such a study has never been made before and its importance cannot be overemphasized. As soon as the results of this study are compiled, they will be published in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

ABENO-CAPES has given scholarships to the following dental teachers: Gastão Pureza Duarte, Helmut Dunker, Ilka Maria Landgraf, José Carlos Borges Teles, José Gustavo de Paiva, Milton Mascarenhas do Amaral, Nicolau Fonseca Milano, Ursula Ella Dunker, Alfredo Nogueira Ferreira, Angenor Mello Sobrinho, Francisco Augusto de Oliveira, José Santos, Kalil Boabaid, Oswaldo dos Santos, Ruy Barbosa Roselino, Salua Iucif, Fernando Aberceb, Flávio Belan dos Santos, José de Oliveira Freitas, Levy de Abreu Cassoni, Moysés Charifker and Plínio Dorneles Machado.

The Point 4 Program, in conjunction with

ABENO, provided for visits with teaching purposes to Professors Cid Menegale, Cláudio Mello, José Cavalcanti Mello, Paulo Assumpção Osório and Roberto Cardoso Fontes. In 1957 it gave scholarships to Francisco Degni to study at Northwestern University, the Universities of Indiana and Michigan, and the National Bureau of Standards; Irineu da Costa Ismar to study at the University of Alabama, and to Salomão Szafiro to study at the University of Brazil. In 1959 the following scholarships were given: Ailton G. Lossio, Dioracy Fonterrada Vieira, and Nelson Thomas Lascala, University of Indiana, and Alcione Dias and Guilherme Simões Gomes, University of Michigan.

ABENO'S members belong to the teaching staffs of Brazilian dental schools. Professor Paulino Guimarães, Jr., has been its president since July 1958, and it has five vice-presidents, one from each geographical zone of Brazil. There are two special commissions, one on teaching and one on scholarships.

From January 11 to February 18, ABENO, CAPES, and the Second Department of Clinics, School of Dentistry, University of São Paulo, are sponsoring a special course for dental teachers designed to bring their scientific knowledge up to date. Subjects are biostatistics, bibliographic research, anatomy, histology, oral surgery, endodontics, periodontics, physiology of pain, physiology of cardiorespiratory system, biochemistry of oral liquid, lesions of the oral mucosa, dental materials, restorative dentistry, nutrition, therapeutics, clinical work in stomatology, and periodontics. The course will last 160 hours and ABENO-CAPES is sponsoring ten scholarships to it.

PUBLIC HEALTH DENTISTRY

The School of Hygiene and Public Health Dentistry, University of São Paulo, is organizing a special nine week course in public health dentistry to begin May 2.

ARMY DENTISTS

According to recent newspaper articles, there are 289 Army dentists in Brazil, divided thusly: 1 colonel, 7 lieutenant colonels, 21 majors, 60 captains, and 200 lieutenants.

Hans Freudenthal, C.D.

News from Great Britain

BRITISH DENTAL ASSOCIATION

The first notices are now published of the Annual Conference 1960 which is planned to take place in Edinburgh July 11-15. For those from abroad who are planning to attend this meeting attention is called to the fact that Edinburgh is a center for tourist travel and because of this there is often a scarcity of hotel accommodation. Bookings should be made directly with the hotels, mentioning that they are for the B.D.A. Conference.

What type of dental health propaganda do practitioners want? This question, put by Mr. W. Stewart Ross, chairman of the Dental Health Committee, was the focal point of a full-scale debate on dental health at the meeting of the Representative Board of the B.D.A.

The problem at the moment seemed to be the type of propaganda which would be most suitable. The profession was beginning to reach the stage where it could make some impact on dental education, and the prestige of the profession in the country would be affected by the efforts which it made in this direction.

Answering a question, Mr. Stewart Ross said the Committee were well aware of the propaganda value of television and radio. He had been speaking recently with B.B.C. officials and had been asked to explain the future of dentistry. No sooner had he mentioned prevention and teaching than the producer of a projected program on "Dentistry as a Career" said that this was not what the program wanted to tell the public. They wanted to let the public know what the dental surgeon had in his surgery to stop pain; they wanted to know about the high-speed drill and whether a tooth could be extracted painlessly. "The man in the street still looks on dentists as tooth pullers. He is not interested in talks about prevention. This is because the profession has failed to educate the public. We must start from the beginning and teach people what the dental surgeon is trying to do."

AMERICAN DENTAL ASSOCIATION

In the November 17 issue of the *British Dental Journal* the editorial headed "Centenary of the American Dental Association" concludes with the following paragraph:

"Although in the history of medicine one hundred years is relatively a brief span, the importance of such a period must be determined by what was achieved during that time. Judged by this criterion the hundred years of the American Dental Association assumes an importance in the field of dental prophylaxis and therapy which is immeasurably of greater value than the ten thousand years which preceded it. Other countries have made their contributions, as our colleagues in the U.S.A. would be the first to declare, but this is the occasion when it should be remembered that there is no country in the world which has not in some way benefited from the work of the A.D.A. and there is none whose dentists would not be eager to offer the A.D.A. the best of wishes for the future."

PARLIAMENT

The Minister of Health was questioned regarding the Standing Committees on Dental Health Education. It was suggested that the Committees were unable to carry on their work adequately because of lack of funds. The Minister contended that the Committees were advisory coordinating bodies and also said that the Committee (England and Wales) was representative of the main interests concerned such as the Central Council for Health Education, the General Dental Council, the British Dental Association, Government Departments, and Local Authorities. It was those interests which spent the money; the Committee was merely an advisory body. In reply to a further question he said that the point was that the bodies who were charged with the executive work were receiving the money and they were spending it.

The Minister of Education was questioned regarding the deficiencies in the School Dental Service and also asked to state what action was being taken to improve the situation in the Service. In reply it was claimed that since 1951 there had been an increase of the equivalent of more than 300 school dentists. In 1958 the number was over 1,000 but twice as many were needed to provide a fully comprehensive service and the shortage could be overcome only by a general increase in the supply of dentists.

In an editorial in the *British Dental Journal* of December 1st headed "Ministerial Irresponsibility" dealing with the School Dental Service, the final paragraphs are as follows:

"If the Minister of Education and his Parliamentary Secretary were to spend even one day in the company of a school dental officer in one of the areas mentioned, the appalling ravages of dental disease amongst children would be brought home to them visually, and they might revise their ideas regarding the extent of their responsibilities.

"The condition of the teeth of the children of this country have for many years been a disgrace to successive Ministers of Education. When a Member of the House raises this matter and puts forward constructive suggestions, the dental profession can only regard it as being a completely irresponsible action on the part of the Minister's lieutenant if he responds to these suggestions with a political gibe."

GENERAL DENTAL COUNCIL

The General Dental Council met for the first time in their new building at 37 Wimpole Street, London, W.1. and the following new members were introduced: Doctors Galloway, Middleton, Sinclair and Thomas, and Professors Boyes, Hopper and Lawton.

Sir Wilfred Fish, who has been re-elected president of the Council for a period of five years, delivered his address which as usual contained many interesting observations and comments of importance to the dental profession in the United Kingdom.

From the reports of committees the following points are noted:

Training of dental hygienists has begun at the Dental School of Manchester. It is hoped that courses at other dental hospitals will begin next year.

Arrangements have been made for the conversion of a building at New Cross General Hospital into a training school for dental auxiliaries under the experimental scheme. It is hoped that the school will open in October 1960. The post of Director has been advertised and the appointment will be made soon.

The Council were informed that by building a new dental school at Cardiff and by expanding some existing schools, the Government intended to increase the total capacity of dental schools in Great Britain from 620 to 890 students. No firm estimate could be given as to when this intention would become a reality, but since no appreciable increase in capacity could be expected for three or four years the Council agreed that for the time being their recruitment measures should be directed particularly towards boys and girls of about 14 years of age.

With the financial support of the British Egg Marketing Board, the Commonwealth Fruits Council, the Flour Advisory Bureau, the National Farmers Union and the National

Milk Publicity Council, the Council are producing a dental health film which it is hoped will be ready for distribution at the beginning of next year.

After considering estimates of income and expenditure for 1959 and 1960 the Council agreed to allocate the sum of £14,200 for expenditure in 1960 on public purposes connected with dentistry, including dental health education, postgraduate education, grants for students, scholarships and minor measures to encourage dentistry as a career.

ITEMS OF INTEREST

The many friends and colleagues both at home and abroad will wish to congratulate Prof. Martin Rushton who, at the opening of the new building for the Dental School of the University of Toronto, was awarded the degree of Doctor of Law *honoris causa* in recognition of his distinguished contribution in the field of dental teaching and practice.

High Speed • An extremely interesting paper by W. A. Vale entitled "Cavity Preparation and Further Thoughts on High Speed" was published in the December 1 issue of the *British Dental Journal*. There is also a most interesting discussion on this paper which is well worth reading.

The American Dental Society of London • The society welcomed to its meeting in November a number of dental officers from the United States who are stationed in Great Britain. The December meeting at which Sir Wilfred Fish spoke on research in clinical practice brought another large attendance and was most successful.

G. H. Leatherman,
D.M.D., F.D.S., R.C.S., F.A.C.D.

News from Sweden

CENTENARY OF THE SWEDISH DENTAL SOCIETY

The year 1960 marks the centenary of the Swedish Dental Society. The society was founded in 1860 and is one of the oldest national dental organizations in the world. Its purpose is to promote the development and practical application of dental science.

The occasion will be celebrated by an International Centenary Congress to be held August 17-20 under the patronage of His Majesty, the King of Sweden.

The Congress will be held in Stockholm at the Concert Hall and at the recently built premises of the Swedish Dental Society, the Apollonia. A four day scientific program will be arranged, covering all fields of dentistry and consisting of lectures, symposiums, panel discussions and table clinics. Prominent researchers and clinicians from all parts of the world will participate. A special series of papers will be read in English by Swedish and other Scandinavian dentists. These papers are intended to give visiting colleagues some idea of the progress of Swedish and Scandinavian dental research and clinics, and to show the present standard of dentistry in the Scandinavian countries. One of these series will show how the public dental health service is conducted in Sweden.

An historical exhibition is planned, including various objects and publications from the past century which will illustrate the scientific and technical development of dentistry up to the present time. An international dental trade exhibition also will be arranged.

Apart from the scientific part of the program, excursions for study purposes as well as social gatherings will be arranged. The main social event will be a Centenary Banquet in the Stockholm City Hall August 20.

A sight-seeing program with visits to places of cultural and historical interest is being prepared for those accompanying the participants in the Congress.

A number of Swedish and Scandinavian travel bureaus, including the Swedish-American Line and SAS, have offered their services in connection with arrangements for the trip to and from the Congress.

Further information about the Centenary Congress, such as details concerning hotel reservations, and so forth, can be obtained from the secretary, Swedish Dental Society, Nybrogatan 53, Stockholm Ö.

A booklet containing more detailed information of the program will be distributed in some quantity to each state dental organization in the United States from the Central Office of the American Dental Association.

Hans Källqvist

reports of councils and bureaus

Survey of state dental service corporations

COUNCIL ON DENTAL HEALTH

In 1957, the Council on Dental Health reported increasing demonstration of the effectiveness of dental service corporations in administering all types of programs for the group purchase of dental care.[1] Specifically, it pointed to the effectiveness of this type of mechanism in (1) maintaining adequate professional control over the operation of group purchase plans for dental care; (2) providing an acceptable substitute for closed panel dental care plans which might be proposed by organized groups; (3) providing an acceptable mechanism for the administration of plans which might be developed under the federal matching formula for public assistance welfare programs and other government programs. As a result of its observations, the Council proposed the following statement of policy which was adopted by the House of Delegates:[2]

Constituent societies which may anticipate the development of sufficient demand for organized plans for the group purchase of dental care should give consideration to the establishment of a dental service corporation but only after consultation with competent legal counsel.

In its continuing study of all methods of payment for dental care, the Council has watched with interest the implementation of the foregoing policy. The numerous requests from dental societies for information on activities in other states and for guidance to society agencies charged with the responsibility for developing programs to increase the availability of dental care to all segments of the population have indicated to the Council that its interest is shared by the entire profession. Inquiries from other sources have indicated, likewise, that the Council's interest extends beyond the profession.

At its annual meeting in April 1959, the Council agreed that a survey should be made if the Association were to fulfill its role of the logical agency to provide dental societies, individuals, private,

public and government agencies with accurate information on the extent to which dental service corporations have been established throughout the country. In June, a questionnaire was mailed to the Association's 54 constituent dental societies. By the end of August, 53 societies had returned completed questionnaires. The Council recognizes that a different economic environment exists in the Panama Canal Zone which is the only area from which no reply was received. In the recapitulation throughout this report, the Panama Canal Zone is included in the "no reply" category.

The questionnaire consisted of three parts. The first was concerned with determining the interest of the public in the development of dental care programs for groups as reflected in inquiries to state societies; the second sought information on the number and status of dental service corporations that had been established; the third related to plans of the dental societies that had not established dental service corporations.

PART I: PUBLIC INTEREST

Ten state dental societies reported that they had received inquiries from agencies representing such groups as employees, public assistance recipients, associations and fraternal orders. The states represented all areas of the country with the exception of the southeast: California, District of Columbia, Massachusetts, Michigan, Minnesota, Missouri, New Mexico, New York, Rhode Island and Washington. Some groups were interested in programs for children only, some for adults and children; some wanted to establish closed panel clinics using salaried dentists. In the majority of instances, lack of funds had deterred the development of programs to date. Forty-two societies reported no inquiries; two did not answer the question.

The development of clinics to supply dental care to organized groups was reported by 14 state societies: California, Southern California, Colorado, District of Columbia, Massachusetts, Michigan, Mississippi, New Mexico, New York, Puerto Rico, Rhode Island, Utah, Washington and Wisconsin. Included were family dental clinics at Air Force bases, labor union welfare fund clinics, management sponsored clinics for employees, government clinics for the indigent and Indians. New York called attention to the *Directory of Dental Clinics in the United States* which is available from the Division of Dental Resources of the United States Public Health Service, and noted that 143 clinics were listed throughout that state. Thirty-eight societies reported that no clinics had been established; two did not reply. One of these was Alabama which explained, however, that the steel mills in Birmingham had employed dentists for a number of years to care for employees. Although Missouri recorded a negative answer, the Council notes that the Labor Health Institute in St. Louis would increase to 15 the number of states having clinics for the provision of dental care to groups.

At the Eighth National Dental Health Conference in 1957, it was pointed out that the state dental society's council on dental health, or equivalent agency, should compile information on the extent of facilities in the state for providing dental care to organized groups.[3] The replies to the third question indicated that only three dental societies could be

recorded as conducting such surveys. They were New York, which has compiled extensive statistical data; Washington, where plans have been made to survey dental facilities in the state for clinics for low income groups, and Utah. Several of the societies misinterpreted the question as referring to fee surveys.

Replies to the fourth question showed that attempts had been made in six states to establish insurance companies to offer dental coverage to the public. In Colorado, no sales were made by a company when it was advised of the poor actuarial plan. In Georgia, two or three dental insurance companies have been established. In Louisiana, a Tennessee company that writes industrial life insurance was authorized to present a family dental expense policy; the Louisiana Dental Association was not in a position to endorse, recognize, participate in or support the plan, and the association had heard nothing further. Two companies have been established and are operating in New York and one in Oklahoma. Two companies in Washington were discontinued through court action. One additional state, Alabama, reported that a stock company tried to organize but failed to raise enough capital. Since the question referred to insurance companies established to offer dental coverage, replies showing "Blue Cross" were excluded. Forty-seven states, including Alabama, reported "no" to the question; one did not reply.

Development of group purchase programs through the insurance industry was reported in four states. Although certain oral surgery procedures are covered by Blue Cross in several states, New Mexico was the only one that so specified. Other states in the "yes" column are New York, Oregon, where an indemnity plan was carried on to a limited extent for one year (1956-57) in conjunction with the ILWU-PMA plan, and Pennsylvania, where the Continental Casualty Company is administering a comprehensive program for the employees of Dentists' Supply Company.[4] Forty-eight states replied that there had been no such development, and two did not reply.

Seven states reported requests for advice and assistance in the development of dental coverage programs through the insurance industry: Alabama, Georgia, Kentucky, Louisiana, New Mexico, Oklahoma and Pennsylvania. Although New York replied "no," the First District Dental Society, a component of the Dental Society of the State of New York, previously has been reported as providing consultation and advice to the Group Health Dental Insurance, Inc., plan in New York City.

The Council has repeatedly called attention to the need for the dental profession to provide advice and assistance in the development of any program for the provision of dental care. In regard to insurance plans, Association objectives were outlined in a 1957 statement of policy.[5] The immediate objective was seen as assisting "in the development of a more effective interpretation of existing health insurance contracts to provide a more satisfactory administration of claims under the contracts so that allowed procedures performed by qualified dentists will entitle the policyholders to reimbursement" while the long-range objective was seen as "the clear identification, within the insurance contracts, of allowed procedures which the policyholder may have performed by qualified dentists." The statement concluded "Negotiations to achieve these objectives can be conducted most effectively through the joint efforts of the Health Insurance Association of America and the American Dental Association.

"In any instance where a constituent dental society is in a position to negotiate effectively with an individual insurance company, that society should consult first with the American Dental Association in order that all efforts may be completely coordinated."

PART II: STATES IN WHICH DENTAL SERVICE CORPORATIONS EXIST

Eight societies reported that dental service corporations had been established: Washington in 1954; California and Oregon in 1955; Michigan in 1957; Colorado, District of Columbia and Missouri in 1958, and Pennsylvania in 1959. Since completion of the survey, two additional dental societies have reported establishment of such an agency. Arkansas announced that a certificate of incorporation was recorded July 6, 1959, "legalizing the formation of the nonprofit Arkansas Dental Service Corporation."[6] The Rhode Island State Dental Society reported the incorporation of such an agency in its state on October 22.[7] Of the ten corporations, eight were established under existing statutes, and two required the enactment of specific enabling legislation.

Three of the 10 corporations are in operation. California administers programs sponsored by the International Longshoremen's and Warehousemen's Union-Pacific Maritime Association Welfare Fund, the ILWU International Union and the East Bay Marine Terminal Association and the dental portion of the Medical Care Plan of the State Department of Social Welfare. Oregon administers the ILWU-PMA program in its state. Washington operates programs for the ILWU-PMA Welfare Fund, ILWU Local 9, the indigent care program for the state of Washington and various school dental accident programs.

Six societies replied that they had considered the possibility of operating the dental service corporation program through the administrative mechanism of an existing Blue Shield corporation, but none reported taking such action. They were: California, Colorado, District of Columbia, Michigan, Pennsylvania and Washington.

The California State Dental Association was the only society to report that the dental service corporation provides services outside its own state, and the answer was qualified "in very limited degree." The District of Columbia and the Washington state dental societies said that such extension would be feasible. In Michigan and Pennsylvania, it was thought possible. The question had not been investigated in Missouri.

PART III: STATES IN WHICH DENTAL SERVICE CORPORATIONS DO NOT EXIST

Twelve societies indicated that they were planning to establish dental service corporations. Arkansas said that such an agency was in the process of being incorporated and that it would be known as the Arkansas Dental Service Corporation [now established]. North Carolina replied that plans were being made "in the event a dental service corporation becomes necessary," South Dakota "providing we can change our state dental laws" and Wisconsin, "our dental economics committee is engaged in a continuing study of the question." The other states in the "yes" column were: Florida, Illinois, Louisiana, New Mexico, Oklahoma, Puerto Rico, Rhode Island [now established] and Texas. Minnesota indicated a qualified "yes," explaining that the issue was under consideration by the society's social research committee.

Twenty-two societies replied that they

Table 1 • Dental Service Corporations established in the United States

State and name of corporation	Year incorporated	In operation	Not in operation	Established under existing statutes	Established under specific enabling legislation
Arkansas*					
Arkansas Dental Service Corporation	1959		X	X	
California					
California Dental Association Service	1955	X		X	
Colorado					
Colorado Dental Service, Inc.	1958		X	X	
District of Columbia					
Dental Service Corporation of the District of Columbia	1958		X	X	
Michigan					
Michigan Dental Service Corporation	1957		X	X	
Missouri					
Missouri Dental Service, Inc.	1958		X	X	
Oregon					
Oregon Dental Service Corporation	1955	X		X	
Pennsylvania					
Dental Service Corporation of Pennsylvania	1959		X		X
Rhode Island*					
Rhode Island State Dental Service Corporation	1959		X		X
Washington					
Washington State Dental Service Corporation	1954	X		X	

*Established after completion of survey.

were not planning to establish dental service corporations: Alabama, Alaska, Arizona, Connecticut, Delaware, Georgia, Idaho, Indiana, Iowa, Kansas, Maine, Maryland, Mississippi, Nebraska, Nevada, New Hampshire, North Dakota, South Carolina, Vermont, Virginia, West Virginia and Wyoming. Although West Virginia is included in this category, its reply was qualified "not at the present time," and it was explained that legislation had been enacted to permit establishment of a dental service corporation should the West Virginia State Dental Society decide to do so.[8] Some of the other answers were qualified similarly or "unless necessary," "has question in study" and so on.

Ten societies did not specify "yes" or "no" on plans for establishing a dental service corporation, but enabling acts had been introduced in the respective legislative bodies of four of these states: in Hawaii, whose reply indicated no definite plans "until the state society is first approached by an organized group," a bill died in committee in the last territorial legislature in April 1959; in New Jersey, a bill was passed by both houses of the state's legislature and was awaiting the governor's signature; in New York, a bill was approved by the legislature but vetoed by the governor because it did not provide for supervision under the state insurance department as is required for such corporations, and a new bill was

Table 2 • Requirements for and status of legislation in states where dental service corporations have not been established

State	Legislation required	Legislation not required	Introduced in legislature	Action	Not introduced in legislature
Alabama					
Alaska	Not determined				X
Arizona					
Arkansas*					
California*					
Southern California					
Colorado*					
Connecticut					
Delaware					
District of Columbia*					
Florida	X				X
Georgia					
Hawaii	X		X	Died in committee of last territorial legislature in April 1959	
Idaho					
Illinois	X				X
Indiana		X			
Iowa					
Kansas					
Kentucky	X		X	Enacted	
Louisiana	X				X
Maine					
Maryland					
Massachusetts					
Michigan*					
Minnesota	X				X
Mississippi					
Missouri*					
Montana		X			
Nebraska	X				
Nevada					
New Hampshire					
New Jersey	X		X	Passed both houses; awaiting governor's signature	
New Mexico	Inquiry in attorney general's office				
New York	X		X	Approved by legislature; vetoed by governor because of failure to provide for supervision by state insurance department	
North Carolina	Do not think so				
North Dakota					
Ohio	X		X	Enacted	
Oklahoma	Currently being studied				
Oregon*					
Pennsylvania*					
Puerto Rico	X				X
Rhode Island*					
South Carolina					
South Dakota	X				X
Tennessee	X				X
Texas	X		X	Insufficient time for consideration and vote	
Utah					
Vermont					
Virginia	X				X
Washington*					
West Virginia	X		X	Enacted	
Wisconsin	X				X
Wyoming		X			

*Dental service corporation established; see Table 1.

being prepared; in Ohio, a bill was enacted. Another of the ten, Montana, explained "only if demand becomes evident" and that articles of incorporation had been prepared and were ready to file. Two of the others, Tennessee and Utah, replied that the action was being studied.

In addition to states previously mentioned as requiring enabling legislation for the establishment of dental service corporations, the following indicated the same requirement: Florida, Illinois, Kentucky (enacted), Louisiana, Minnesota, Nebraska, Puerto Rico, South Dakota, Tennessee, Texas and Wisconsin.

Indiana, Montana and Wyoming will not require specific legislation. Alaska replied that it did not know about the requirement; New Mexico, that it has an inquiry in the attorney general's office; North Carolina, that it does not think so at this time, and Oklahoma, that it is being studied currently.

With regard to the status of such legislation, Florida explained that a bill had not been prepared, that it could not be presented until the next meeting of the Florida legislature which is two years away. Illinois has prepared a bill which is being presented to components; if approved by the state society, the bill will be presented at the next session of the legislature. Texas had a bill pending before its legislature. [Information has since been obtained from Texas that the enabling act was introduced too late to be presented on the floor for a vote. There was no apparent opposition to the bill, and failure of passage was attributed to lack of time for consideration.] Wisconsin's legislative committee was "in the process of formulating such a bill." Louisiana, Minnesota, Puerto Rico, South Dakota and Tennessee also indicated that legislation had not been introduced. Nebraska did not indicate.

COMMENT BY COUNCIL

The Council feels that the survey of state dental service corporations has produced basic information on the extent to which this method for making dental services available has developed; that it has disclosed, likewise, the need for constituent dental societies to survey their respective states to determine the extent of facilities for providing dental care to organized groups. The Council acknowledges the prompt and commendable cooperation of the constituent societies in providing the requested information. In order that the Association may fulfill its logical role of authoritative source of information in this area, all constituent societies are urged to keep the Council informed of activities related to group purchase of dental care in their respective states.

1. American Dental Association. Transactions 1957, p. 95.

2. American Dental Association. Transactions 1957, p. 389.

3. American Dental Association. Council on Dental Health. The state council on dental health program and the support available from the Association. J.A.D.A. 55:112 July 1957.

4. New group dental care plan hailed by profession. Dental Health Highlights 15:29 August 21, 1959.

5. American Dental Association. Transactions 1957, p. 390.

6. The Arkansas Dental Service Corporation. Arkansas D. J. 30:12 Dec. 1959.

7. Personal communication from Hubert A. McGuirl, executive secretary, Rhode Island State Dental Society, Nov. 3, 1959.

8. Three more states enact legislation for dental service corporation. Dental Health Highlights 15:27 July 10, 1959.

Survey of dentist opinion
VI. Dental materials

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

The questions relating to dental materials were answered by fewer of the 5,291 survey respondents than most other questions. Several of the questions on dental materials required the respondent to explain or to give reasons. As a general rule, in mail surveys such questions are answered by fewer respondents than "check off" type questions.

Most of the questions asked for information on troubles dentists had with certain dental materials; the low number of complaints suggests that dentists are relatively well satisfied with those materials. Information submitted by respondents on "brand preference" is omitted from this analysis.

Survey participants were asked "What brands of inlay casting investment have you had trouble with? What were the troubles?" The types of troubles mentioned are listed in Table 54. Even the most common complaint (roughness) was mentioned by only 71 dentists.

Dentists were asked to indicate whether they preferred "thermal type" or "hygroscopic type" of inlay casting investment, and the reason for the preference. The number of dentists giving each reason for each type is shown in Table 55. The hygroscopic type of inlay casting investment was preferred by about twice as many dentists as was the thermal type. The reasons given most often for this preference were that the dentist had been "taught to use it," "had no experience with thermal type," "works well" or "gives satisfactory results." The following characteristics were attributed more often to the thermal than to the hygroscopic type: accuracy, controlled expansion and smooth casting.

"What properties of present inlay casting investment need to be improved?" Replies to this question are given in Table 56. "Increase strength" was the most common reply, followed by "decrease setting time."

To the question "What troubles have you had with gold colored wires and with white gold wires," 299 dentists mentioned troubles with gold colored wires and 153 with white gold (Table 57). "Tarnishing" and "discoloration" were the most

Table 54 • Number of respondents citing specified types of trouble with inlay casting investment

Type of trouble	Number of respondents
Rough surface—rough casting	71
Under-expansion	37
Cracking—material cracks in heating	32
Poor fitting	21
Bad expansion	14
Lacks control	14
Other	102

Table 55 • Number of respondents citing specified reasons for preference of thermal type or hygroscopic type of inlay casting investment

Reason	Number of respondents	
	Thermal type	Hygroscopic type
Taught to use—more familiar with this type—no experience with the other type	64	375
Works better in my hands—easier to work with	42	335
Get good results—satisfactory results	118	254
Greater accuracy	103	59
Controlled expansion	66	48
Speedier	10	67
Smoother casting	61	16
Greater accuracy and smoother casting	16	6
Other	24	29
Total	504	1,189

Table 56 • Number of respondents suggesting improvements in inlay casting investments

Response	Number of respondents
Increase strength	624
Decrease strength	8
Increase expansion	173
Decrease expansion	90
Increase setting time	238
Decrease setting time	321
Other	61

Table 57 • Number of respondents citing specified types of trouble with gold colored wires and white gold wires

Type of trouble	Number of respondents	
	Gold colored wires	White gold wires
Breaks—too brittle	100	88
Tarnishes—discolors upon usage	122	25
Too soft	20	4
Soldering difficulties	11	7
Too weak	11	4
Other	35	25
Total	299	153

common complaints regarding gold colored wires.

In spite of the fact that more dentists mentioned troubles with gold colored than with white gold wires, dentists preferred "gold colored" to "white gold" by nearly two to one (Table 58). Of several reasons given, "patient acceptance" predominated.

Respondents were asked what proper-

Table 58 • Number of respondents citing specified reasons for preferring gold colored or white gold wires

Reason	Number of respondents	
	Gold colored wires	White gold wires
Better looking	72	56
Stronger	60	32
Greater patient acceptance—patient preference	75	7
Less conspicuous	15	52
Works better—easier to work with	40	5
Less discoloration	12	15
Other	52	4
Total	326	171

Table 59 • Number of respondents suggesting improvements in wrought gold wire

Response	Number of respondents
Increase content of gold and platinum group metals	190
Decrease content of gold and platinum group metals	10
Raise melting range	88
Lower melting range	18
Increase stiffness	279
Decrease stiffness	109
Other	53

Table 60 • Number of respondents citing specified types of trouble experienced with alginate hydrocolloidal impression materials

Type of trouble	Number of respondents
Setting time inconsistent	112
Setting time too slow	68
Setting time too fast	37
Mix not stiff enough—too soft—too thin—lacks body	63
Mix too stiff—too tough—too hard—too heavy	31
Poor model surface—rough surface	85
Dimensional change—shrinks	55
Poor impressions—easily distorted	54
Difficult to remove from model	54
Other	246

Table 61 • Number of respondents citing specified unsatisfactory properties of denture lining resins

Unsatisfactory property	Number of respondents
Lack of color stability—discolors—changes color	74
Bad porosity—shows bubbles	46
Rough surface—no gloss	16
Unpleasant odor	16
Hard to clean	10
Does not set—sets badly	5

Table 62 • Number of respondents citing specified unsatisfactory properties of zinc oxide-eugenol impression pastes

Unsatisfactory property	Number of respondents
Does not set hard	26
Too messy to work with	18
Sets too fast	12
Sets too slow	12
Too hard	9
Too granular	9
Inaccurate	8
Not enough body	5
Other	28

Table 63 • Number of respondents answering as indicated to the question "If you use diamond stones in laboratory technics, in what ways do you use them?"

Use	Number of respondents
To cut porcelain—grind denture teeth	241
For crown and bridge work	64
For gross preparation	25
For operative work	23
To cut acrylic resin	14
For pontic preparation	13
Other	137

Table 64 • Number of respondents citing specified unsatisfactory properties of diamond stones

Unsatisfactory property	Number of respondents
Wears out too fast	91
Diamond abrasives do not adhere	52
Does not hold up—breaks	42
Too rough	15
Does not cut	12
Unequal size	6
Other	37

Table 65 • Number of respondents preferring specified shapes of diamond stones

Shape	Number of respondents
Wheel	493
Tapered	308
Inverted cone	301
Disk	238
Cylinder	209
Round	130
Barrel	64
Knife edge	41
Tapered cylinder	39
Pointed cone	27
Other	264

ties of wrought gold wire they would like to see improved (Table 59). "Increase stiffness" was checked by 279 dentists and "increase content of gold and platinum group metals" by 190.

Types of troubles with alginate hydrocolloidal impression materials reported by dentists are shown in Table 60. "Inconsistent setting time" was the type of trouble mentioned most frequently. "Roughness of the model surface" also was mentioned by a relatively large number of dentists.

Table 61 lists "unsatisfactory properties" of denture lining resins (self-curing types that are used as a wash impression and then harden to form a temporary reline). Respondents mentioned "lack of color stability" more frequently than any other characteristic.

Dentists' criticisms of zinc oxide-eugenol impression pastes are shown in Table 62. Most of the comments related to setting time or hardness.

The purposes for which diamond stones were used are listed in Table 63. "Cutting porcelain" or "grinding denture teeth" was the use mentioned most frequently. Properties of diamond stones considered to be unsatisfactory are shown in Table 64.

The number of dentists expressing preference for each shape of diamond stone is presented in Table 65. The terms in the table are those used by the respondents, and it is possible that in some instances there is "a distinction without a difference."

The analysis of the Survey of Dentist Opinion will be concluded in a subsequent edition of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

Supplement to List of Certified Dental Materials

COUNCIL ON DENTAL RESEARCH

ADDITIONS • Since publication of the most recent List of Certified Dental Materials, revised to May 1, 1959 (J.A.D.A. 59:130 July 1959), the following materials which conform to American Dental Association Specification No. 1 for Dental Amalgam Alloys have been added.

CERTIFIED DENTAL AMALGAM ALLOYS
(A.D.A. SPECIFICATION NO. 1)

Alloy	*Manufacturer or distributor*
Filling Alloy	Pure-Lab Company of America
695 Regular; Fast	W. E. Mowrey Co.
Silverman's Ex-cel	L. Silverman Dental Supplies
Zinc Free True Dentalloy	The S. S. White Dental Mfg. Co.
S-C Medium (pellets)	Stratford-Cookson Co.

book reviews

DIE ZAHN-, MUND- UND KIEFERHEILKUNDE: EIN HANDBUCH FÜR DIE ZAHNÄRZTLICHE PRAXIS (THERAPY OF THE TEETH, MOUTH AND JAWS: A MANUAL FOR THE DENTAL PRACTICE)

Edited by Karl Häupl, Wilhelm Meyer and Karl Schuchardt. Five volumes. 1,525 pages with 5,344 illustrations. Index. For sale in complete set only. DM. 650. München, Urban & Schwarzenberg, 1954-1959.

Issue 32 contains parts of volume III (General and Specialized Surgery of the Mouth and the Jaws).

IRRADIATION THERAPY • By B. Lindemann. 79 pages with 23 illustrations.

Lindemann's contribution presents a brief but complete outline and discussion of roentgenotherapy of the maxillofacial region. It may serve as a useful reference material for the dental roentgenologist and for those dentists who are doing a limited amount of maxillofacial roentgenotherapy. It should, therefore, find its place on the shelf of every dental practitioner who attempts roentgenotherapeutic procedures for nonsurgical treatment of benign and malignant lesions appearing in the maxillofacial region. The illustrations are of excellent quality and can be interpreted easily. The concise manner of subject presentation as well as the brevity of the text are commendable.

SPEECH DEFECTS AND THEIR TREATMENT • By F. A. Doubek. 20 pages with 25 illustrations.

As the field of dentistry has become more complex, it has become more difficult for the dentist to treat not only dental and oral diseases but the patients themselves. The busy dental practitioner has neither the time nor the specialized training to give full consideration to all psychologic, social, economic and vocational aspects associated with his work. This holds true especially concerning patients with speech defects. To meet this urgent need, there has been an increasing tendency to include dentists on a team consisting of physicians, surgeons and phoniatricians. This team, cooperating in the study, treatment and rehabilitation of patients with speech defects, especially defects caused by cleft palate, needs the experience and knowledge of the dentist to cope with diseases or disorders of the organs of speech. Although written mainly for the specialist members of the speech therapy team, Doubek's contribution will be interesting and useful for dental practitioners concerned with the treatment and rehabilitation of their speech-handicapped patients.

OTORHINOLARYNGOLOGY, A FIELD BORDERING ON DENTISTRY • By G. Jung. 22 pages with 14 illustrations.

Knowledge of the ear, nose and larynx and their diseases should play an important part in the postgraduate study of dentists, because there exists an interrelationship between dentistry and otorhinolaryngology. Certain diseases and disorders of the nose, ear and the larynx such as acute laryngitis or angina, tonsillitis, abscesses, pharyngitis, benign and malignant tumors, acute or chronic sinusitis, cysts and hemorrhages often have their initial manifestations in the oral cavity. Jung's work is essentially devoted to the relationship between otorhinolaryngology and dentistry in diagnosis and treatment of specific conditions. The descriptions are brief, although case reports, symptomatology, and physical findings are usually included. Obviously, Jung did not intend to write a voluminous source of information but he included references for dentists desiring additional details.

There will be some readers who find that comparatively brief outlines are inadequate for use by the dental practitioner or student; such short description of a specialized region related to dentistry, however, provides information which is often needed quickly in dental practice. There will be many dentists who desire to be informed of otorhinolaryngologic treatment procedures, leaving details concerning other measures to specialized textbooks. Jung's presentation is worthy of trial and provides interesting reading. If such a limitation is kept in mind, brief outlines of specialized medical fields are often helpful to dental practitioners.

UNSPECIFIC INFLAMMATIONS OF THE SOFT TISSUES ADJACENT TO THE JAWS • By A. Eckstein. 52 pages with 33 illustrations.

Eckstein's contribution emphasizes diagnosis and treatment of bacterial infections of the soft tissues of the oral cavity, and the necessity of making the diagnosis on an etiologic basis. The reading of this interesting paper is recommended to dental practitioners and students. The illustrations are appropriate and clearcut. An outstanding feature is the reference material to the pertaining literature which includes many American authors. Although it seems impossible for any author of such a brief discussion to keep abreast of the rapid advances in antibiotic therapy, no serious mistake will be made if Eckstein's recommendations are followed by dental practitioners.

OSTEOMYELITIS OF THE JAWS • By B. Spiessl. 42 pages with 37 illustrations.

The author points out that his work is intended to provide a review of case reports and clinical procedures to be helpful in diagnosis and treatment of osteomyelitis of the jaws. He makes no attempt to present textbook material, but he illustrates in words and pictures the types of osteomyelitic defects of the jaws and their probable underlying pathologic conditions. This is a most practical presentation of the subject and is well worth careful study by dental practitioners, oral surgeons and dental students.

Paul H. Glucksman

BOOKS RECEIVED BUT NOT REVIEWED

FIT FOR COLLEGE • Report of the College Physical Education Association. 24 pages. 50c. American Association for Health, Physical Education and Recreation, 1201 16th St., N.W., Washington 6, D.C., 1959.

A SURVEY OF THE DENTAL NEEDS IN STATE-MAINTAINED INSTITUTIONS IN NEW MEXICO • By Charles H. Davis, D.M.D. 25 pages. Division of Dental Health, New Mexico, Department of Public Health, Box 711, Santa Fe, N. Mex., 1959.

PSYCHOLOGICAL SERVICES IN VOCATIONAL REHABILITATION • By Salvatore G. DiMichael. 53 pages. 20c. U. S. Department of Health, Education and Welfare, Office of Vocational Rehabilitation, Washington 5, D. C., 1959.

DELINQUENT BEHAVIOR: PRINCIPLES AND PRACTICES • By William C. Kvaraceus and William E. Ulrich. 350 pages. $2. National Education Association, 1201 16th St., N.W., Washington 6, D. C., 1959.

REPORT ON THE NATIONAL CONFERENCE ON THE LEGAL ENVIRONMENT OF MEDICAL SCIENCE, MAY 27, 28, 1959 • Sponsored by the National Society for Medical Research and the University of Chicago. 114 pages. $2.50. National Society for Medical Research, 920 S. Michigan Ave., Chicago 5, 1959.

RESUSCITATION OF THE UNCONSCIOUS VICTIM: A MANUAL FOR RESCUE BREATHING • By Peter Safar, M.D. and Martin C. McMahon. 79 pages with illustrations. $1.75. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1959.

RATIONALIZED ROOT CANAL TREATMENT • By Ang. G. Sargenti, Dr. Med. Dent. and Samuel L. Richter, Dr. Med. Dent. 207 pages with illustrations. $12.50. AGSA Scientific Publications, 509 Fifth Ave., New York 17, 1959.

PRINCIPLES OF DISABILITY EVALUATION • By Wilmer Cauthorn Smith, M.D. 210 pages with illustrations. $7. J. B. Lippincott Company, East Washington Square, Philadelphia 5, 1959.

current literature

MY EXPERIENCES AS A DENTAL INTERNE

By Anthony M. Schiano. J.Florida D.Soc. 30:2:10 Aug. 1959.

While completing my senior year in dental school, the opportunity came of accepting a one year oral surgery internship at Jackson Memorial Hospital. On arrival at the hospital, I was made welcome by the hospital and oral surgery staffs. The physical plant and my duties were explained.

During my internship, I encountered three types of patients: (1) the ambulatory patient or outpatient, (2) the hospitalized or house patient, and (3) the emergency patient.

Most ambulatory patients coming to the dental clinic already had been seen by staff members of another clinic for some medical disorder. I reviewed the patient's record and familiarized myself with his history. It was surprising how valuable such a procedure proved to be. Positive roentgenographic evidence always was used in making a diagnosis. If surgery was to be performed, the patient was evaluated as to the proper anesthetic, the choice of emergency drugs and premedications, what medical consultation or clearance was necessary, and what assistance, if any, would be needed from the resident, chief, or attending staff member. Postoperative care was planned.

On certain nights, I was on call for oral surgery service. Here I had the opportunity to decide whether or not house patients were to be admitted. Factors involved in the decision included the patient's history, the clinical evidence, the roentgenographic findings, and whether surgery would improve the patient's condition. If I felt I could not cope with the circumstances, I did not hesitate to call my resident for assistance. When the patient was admitted, a complete history was written in the charts supplied. When the patient had been made comfortable, the case was reviewed by all concerned—the chief of service, attending staff, resident and interns. If the patient was scheduled for the operating room, I tried to assist the resident in any manner he asked. The work in all operating rooms follows a strict schedule. I reported 10 to 15 minutes early and "checked out" the operating room, making sure that the necessary instruments, materials and roentgenograms were present. I scrubbed and gowned according to hospital rules. When the operation was concluded, the patient was taken to the recovery room and postoperative orders were written. The patient was seen daily at rounds which were held every morning. When the patient was discharged, a summary was written on the chart; it included the diagnosis, treatment and prognosis. Any special instructions and medications for home care were given at this time.

A representative of the oral surgery service was always on call to deal with any emergency which might arise. Here I confronted patients with many types of conditions.

I spent two months full-time with the department of anesthesiology. I became familiar with the various anesthetic agents, and was given the opportunity to administer these agents both to ambulatory dental and hospital general surgery patients.

At weekly tumor board conferences I was given the opportunity to listen to specialists in all fields of medicine, including my own, review interesting cases.

The oral surgery internship has increased my confidence in meeting situations similar to those experienced during my internship. It has stimulated my interest to further my education in oral surgery. My appreciation of the related sciences has been enhanced. I have come to recognize fully the need for good interpersonal relations and rapport between the oral surgeon and the physician.

I recommend an oral surgery internship to the individual who is interested in commencing his formal oral surgical education. The internship will prepare the individual for the residency periods which are to follow.

deaths

BUREAU OF MEMBERSHIP RECORDS

Albright, Lewis G., St. Petersburg, Fla.; Chicago College of Dental Surgery, 1902; died September 28; age 86.

Allen, J. Maxwell, Charlotte C. H., Va.; died August 16; age 55.

Angel, Nicholas M., New York; College of Dental and Oral Surgery, 1923; died September 6; age 63.

Armstrong, Robert B., Raytown, Mo.; University of Kansas City School of Dentistry, Kansas City Western Dental College, 1959; died September 21; age 44.

Auerbach, Maximilian, Saugerties, N. Y.; Ohio State University College of Dentistry, 1933; died September 11; age 59.

Baer, Cecil A., Columbus, Texas; University of Texas School of Dentistry, 1945; died September 22; age 42.

Beall, Edmund N., St. Louis; Marion-Sims College of Medicine Dental Department, 1898; died September 22; age 82.

Bessie, Adolphe J., Detroit; University of Michigan School of Dentistry, 1925; died September 12; age 61.

Beyer, Walter E., Indianapolis; Central College of Dentistry, 1903; died September 3; age 78.

Bishop, Charles G., Daytona Beach, Fla.; University of Maryland Dental Department, 1902; died August 23; age 79.

Blair, Lester G., Newtonville, Mass.; Tufts College Dental School, 1923; died September 9; age 58.

Bland, Thomas J., Jr., Baltimore; Baltimore College of Dental Surgery, University of Maryland, 1917; died August 29; age 66.

Boyd, Hurst V., Syracuse, N. Y.; Chicago College of Dental Surgery, 1911; died August 21; age 72.

Bradshaw, Ralph R., St. Paul; University of Minnesota School of Dentistry, 1925; died September 9; age 58.

Brandow, George R., Aberdeen, Md.; Baltimore College of Dental Surgery, University of Maryland, 1924; died August 21; age 60.

Brooks, Harry A., Milwaukee; Marquette University Dental School, 1911; died September 24; age 69.

Bryson, Guy E., Celina, Ohio; Ohio College of Dental Surgery, University of Cincinnati, 1907; died August 17; age 74.

Cameron, Michael C., Flint, Mich.; University of Michigan School of Dentistry, 1919; died August 24; age 64.

Campbell, Dayton D., Kansas City, Mo.; Kansas City Dental College, 1902; died October 16; age 77.

Caron, William G., Nashua, N. H.; Tufts College Dental School, 1923; died October 12; age 63.

Carter, Robert W., New York; Tufts College Dental School, 1924; died September; age 60.

Connor, Welker C., Fort Wayne, Ind.; Indiana Dental College, 1922; died July 31; age 59.

Daniels, Frederick C., East Grand Rapids, Mich.; University of Michigan School of Dentistry, 1914; died August 18; age 68.

DeFernelmont, Eugene, Philadelphia; University of Maryland, Dental Department, 1903; died September 27; age 82.

Drazkowski, John P., Ironwood, Mich.; University of Michigan School of Dentistry, 1914; died August 31; age 67.

Dunham, Donald C., Syracuse, N. Y.; University of Buffalo School of Dentistry, 1923; died September 27; age 62.

Dykeman, Edward J., Melbourne, Fla.; Indiana Dental College, 1904; died September 18; age 83.

Eleazer, John R., Greenville, Texas; Vanderbilt University School of Dentistry, 1899; died August 11; age 84.

Erwin, Luther F., Crossville, Ala.; Southern Dental College, 1904; died July 13; age 84.

Eustice, Will C., Elizabeth, Ill.; Northwestern University Dental School, 1898; died August 23; age 83.

Ferguson, George A., Cedar Springs, Mich.; Detroit College of Medicine, Department of Dental Surgery, 1907; died September 22; age 87.

Foster, Arthur J., Akron, Ohio; University of Buffalo School of Dentistry, 1904; died August 25; age 78.

Friduss, Mandel, Chicago; Chicago College of Dental Surgery, 1922; died October 9; age 61.

Friedlander, Jack N., Lynbrook, N. Y.; University of Illinois College of Dentistry, 1937; died July 22; age 51.

Gage, Leo E., Johnstown, Ohio; Starling-Ohio Medical College Department of Dentistry, 1908; died September 17; age 77.

Goldstein, Morton M., Fort Lewis, Wash.; University of Kansas City School of Dentistry, Kansas City-Western Dental College, 1954; died August 4; age 29.

Hayes, William J., Syracuse, N. Y.; University of Buffalo School of Dentistry, 1940; died September 29; age 47.

Herrick, Ernest M., East Cleveland, Ohio; Western Reserve University School of Dentistry, 1907; died August 15; age 76.

Heywood, Townsend N., Columbus, Ohio; Cincinnati College of Dental Surgery, 1902; died September 10; age 83.

Hill, Gilbert M., Tacoma, Wash.; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1929; died September 8; age 57.

Hipson, Harry H., Stuart, Fla.; University of Pennsylvania School of Dentistry, 1923; died September 5; age 63.

Holmes, Daniel A., Milwaukee; Marquette University Dental School, 1925; died October 3; age 57.

Hopkins, Frank C., Alton, Ill.; University of Washington School of Dentistry, 1901; died September 29; age 81.

Huber, Russell E., Dayton, Ohio; University of Michigan School of Dentistry, 1932; died August 26; age 50.

Huschle, Henry J., East St. Louis, Ill.; St. Louis University School of Dentistry, 1918; died August 27; age 62.

Ireland, Stanley A., Lansdowne, Pa.; Medico-Chirurgical College of Philadelphia, 1902; died September 29; age 78.

Jacobsmeyer, J. Albert, Miami, Fla.; Washington University School of Dentistry, 1917; died September 8; age 64.

Joseph, T. Cedwyn, Scranton, Pa.; Temple University School of Dentistry, 1909; died September 5; age 73.

Kaplan, Hyman, Plainfield, N. J.; College of Jersey City Department of Dentistry, 1917; died September 11; age 64.

Krieger, Leon, New York; Columbia University School of Dentistry and Oral Surgery, 1931; died October 8; age 61.

Kuperman, Adolph, Detroit; Chicago College of Dental Surgery, 1913; died August 27; age 79.

Lotz, Harry F., Lockport, Ill.; Philadelphia Dental College, 1896; died September 28; age 90.

Lubick, Herman, Pittsburgh; died September 14; age 67.

Lund, Axel P., Minneapolis; University of Minnesota School of Dentistry, 1941; died September 1; age 58.

Marshall, George W., Roseburg, Ore.; North Pacific College of Oregon School of Dentistry, 1918; died September 26; age 75

Marshall, Thomas A., St. Petersburg, Fla.; Vanderbilt University School of Dentistry, 1925; died September 30; age 55.

McGehee, William H. O., Washington, D. C.; University College of Medicine Dental Department, 1897; died September 25; age 85.

McMahon, Harry T., White Plains, N. Y.; University of Michigan School of Dentistry, 1920; died September 8; age 66.

McNinch, Joseph S., Chicago; Northwestern University Dental School, 1903; died July 17; age 77.

Norris, Charles C., Oshkosh, Wis.; Chicago College of Dental Surgery, 1900; died September 11; age 86.

Pohle, Ishmael T., Grosse Pointe Woods, Mich.; Marquette University Dental School, 1924; died September 6; age 57.

Ratner, George P., New York; New York College of Dentistry, 1913; died September 4; age 68.

Redeman, Ernest H., Marinette, Wis.; Milwaukee Medical College Dental Department, 1905; died August 22; age 76.

Reilley, Raymond A., Chicago; Northwestern University Dental School, 1917; died October 18; age 63.

Reiter, William N., Cleveland; Ohio State University College of Dentistry, 1915; died October 2; age 70.

Renouf, Joseph N., Kent, Ohio; Western Reserve University School of Dentistry, 1904; died September 22; age 76.

Rouf, Jacob M., Chicago; Northwestern University Dental School, 1897; died September 11; age 92.

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THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION
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MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

One-Hundred and First Annual Session	October 17-20, 1960	Los Angeles
One-Hundred and Second Annual Session	October 16-19, 1961	Philadelphia
One-Hundred and Third Annual Session	October 29-November 1, 1962	Miami Beach, Fla.
One-Hundred and Fourth Annual Session	October 14-17, 1963	Atlantic City, N.J.
One-Hundred and Fifth Annual Session	November 9-12, 1964	San Francisco

MEETINGS OF CONSTITUENT SOCIETIES

State	*Date*	*Place*	*Secretary and Address*
Alabama	Apr. 21-23	Birmingham	C. R. Crook, Professional Center, Montgomery
Alaska	July 5-7	Juneau	W. E. Alexander, 406 G St., Anchorage
Arizona	Apr. 20-23	Tucson	W. G. Burke, 15 E. Monroe St., Phoenix
Arkansas	Apr. 3-6	Little Rock	D. M. Hamm, Box 89, Clarksville
California	Apr. 24-27	San Francisco	W. J. Healy, 518 Sutter St., San Francisco 8
S. California	May 2-4	Los Angeles	J. H. Thomason, 903 Crenshaw Blvd., Los Angeles 19
Colorado	Oct. 2-5	Colorado Springs	G. H. Siersma, 724 Republic Bldg., Denver 2
Connecticut	May 18, 19	Hartford	E. S. Arnold, 37 Linnard Rd., W. Hartford
Delaware	June 10, 11	Wilmington	E. J. Truono, 1401 Gilpin Ave., Wilmington 6
Dist. of Columbia	Mar. 13-16	Washington	J. F. Keaveny, 1835 Eye St., N.W., Washington 6
Florida	May 15-18	Miami Beach	R. Chace, 518 Tampa St., Tampa
Georgia	Oct. 2-5	Savannah	F. M. Butler, Jr., 701 Southern United Bldg., Macon
Hawaii	Oct. 24-27	Honolulu	J. H. Dawe, Alexander Young Bldg., Honolulu 13
Idaho	Sept. 15-17	Sun Valley	H. E. Burgess, 151 Fourth Ave., N., Twin Falls
Illinois	May 11-13	Rockford	P. W. Clopper, 632 Jefferson Bldg., Peoria
Indiana	May 16-18	Indianapolis	C. L. Howell, 1012 Hume Mansur Bldg., Indianapolis 4
Iowa	May 2-4	Des Moines	H. N. Hake, 639 Insurance Exchange Bldg., Des Moines 9
Kansas	May 1-4	Wichita	F. A. Richmond, Brotherhood Bldg., Kansas City 1
Kentucky	Mar. 31-Apr. 2	Lexington	A. B. Coxwell, Jr., 2208 Dundee Rd., Louisville 5
Louisiana	Apr. 27-30	New Orleans	J. S. Bernhard, 231 Atkins Ave., Shreveport 26
Maine	June 16-18	Rockland	S. M. Gower, 6 Coburn Ave., Skowhegan
Maryland	June 8-12	Atlantic City	W. Schunick, 19 Medical Arts Bldg., Baltimore 1
Massachusetts	May 1-4	Boston	H. E. Tingley, 227 Commonwealth Ave., Boston
Michigan	May 2-4	Detroit	F. Wertheimer, Michigan Dept. of Health, Lansing
Minnesota	Apr. 25-27	St. Paul	C. V. E. Cassel, 2236 Marshall Ave., St. Paul 4W
Mississippi	Apr. 24-27	Jackson	M. C. O'Keefe, Medical Arts Bldg., Jackson 2

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Montana	May 5-7	Missoula	R. C. Ritter, 1236 N. 28th St., Billings
Nebraska	April 25-27	Omaha	F. A. Pierson, Federal Securities Bldg., Lincoln
Nevada	June	Elko	O. M. Seifert, 755 Ryland Ave., Reno
New Hampshire	June 12-15	Whitefield	F. E. Williams, 814 Elm St., Manchester
New Jersey	Apr. 25-28	Atlantic City	J. G. Carr, 407 Cooper St., Camden
New Mexico	May 15-18	Albuquerque	W. A. Blueher, 24 Medical Arts Sq., N.E., Albuquerque
New York	May 9-11	Buffalo	C. A. Wilkie, 268 Ashland Pl., Brooklyn 17
North Carolina	May 1-4	Pinehurst	S. B. Towler, P.O. Box 11065, Raleigh
North Dakota	Sept. 11-13	Williston	D. R. Perry, Box 866, Bismarck
Ohio	Nov. 13-16	Columbus	E. G. Jones, 185 E. State St., Columbus
Oklahoma	Apr. 24-27	Oklahoma City	L. D. Wright, 210 Plaza Court Bldg., Oklahoma City
Oregon	Mar. 7-9	Portland	T. D. Holder, Selling Bldg., Portland
Panama C. Z.	April	Ancon	G. E. Lilly, Box 29, Ft. Clayton
Pennsylvania	May 12-14	Harrisburg	I. Sissman, 217 State St., Harrisburg
Puerto Rico			R. Gonzalez R., Box 10452, Caparra Heights
Rhode Island			C. A. Spacagna, Union Trust Bldg., Providence
South Carolina	May 8-10	Greenville	J. E. Wallace, 1506 Gregg St., Columbia
South Dakota	May 15-1	Sioux Falls	R. E. Decker, Box 308, Parker
Tennessee	May 1-5	Memphis	K. P. Ezell, 119 Louise Ave., Nashville 5
Texas	Apr. 24-27	Fort Worth	C. A. McMurray, 3707 Gaston Ave., Dallas 10
Utah	Apr. 14-16	Ogden	R. C. Dalgleish, 1554 Princeton Ave., Salt Lake City
Vermont	June 24-26	Vergennes	E. C. Woods, 128 Merchants Row, Rutland
Virginia	Apr. 24-27	Richmond	M. E. Henderson, Shenandoah Bldg., Roanoke 11
Washington	Mar. 20-23	Seattle	G. D. Dore, Jr., 211 Medical Dental Bldg., Seattle 1
West Virginia	July 17-20	White Sulphur Springs	G. N. Casto, Jr., 710½ Lee St., Charleston
Wisconsin	May 9-11	Milwaukee	C. J. Baumann, Jr., 704 W. Wisconsin Ave., Milwaukee
Wyoming	June 16-18	Jackson	T. J. Drew, State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary and Address
Alabama	June 19-25* June 20†	Birmingham	W. L. Smith, 524 Chestnut St., Gadsden
Alaska	July 5-8	Anchorage	E. I. Baggen, Box 1394, Fairbanks
Arizona	June 19-30	Florence	W. G. Biddulph, 1611 N. Second Ave., Glendale
Arkansas	June 20-25*†	Little Rock	G. Cone, 113 S. Pecan St., Osceola
California			J. F. Steen, 507 Polk St., San Francisco
Colorado	June 19-25	Denver	B. DeRose, Republic Bldg., Denver 2
Connecticut			A. P. Delfini, 265 Church St., New Haven
Delaware			J. F. Maguire, 1200 N. Van Buren St., Wilmington
Dist. of Columbia			W. T. Birthright, 1835 Eye St., N.W., Washington
Florida	July 3-14* July 3, 4†	Jacksonville	R. P. Taylor, Jr., P.O. Box 2913, Jacksonville 3
Georgia	May 30-June 1*†	Atlanta	H. M. Robertson, 206 Donehoo St., Statesboro
Hawaii	Feb. 18-22‡		J. Y. Ing, James Campbell Bldg., Honolulu
Idaho			W. M. Smith, 305 Fort St., Boise
Illinois			R. I. Humphrey, 185 N. Wabash Ave., Chicago

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Iowa	June 6-10*†	Iowa City	P. A. Hahn, Farmers & Merchants Bank Bldg., Burlington
Kansas			R. C. Windscheffel, Medical Arts Bldg., Smith Center
Kentucky	June 6-9*†	Louisville	J. J. Kelly, 102 W. Madison St., Franklin
Louisiana	May 29-June 3	New Orleans	A. R. deNux, 617 N. Monroe St., Marksville
Maine			A. S. Appleby, Box 260, Skowhegan
Maryland	June 6-8*†‡		F. J. Bryce, 303 Granville Dr., Silver Spring
Massachusetts			C. R. Williams, 33 State House, Boston
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Montana			R. O. Betzner, 303 Power Block, Helena
Nebraska			H. E. Weber, Stuart Bldg., Lincoln
Nevada			R. Whitehead, Box 1547, Reno
New Hampshire	June 16, 17* June 16†	Boston	L. U. Bergeron, 211 High St., Somersworth
New Jersey	June 2, 3*† June 6, 7*† June 13, 14* June 16, 17*† June 20, 21*†	New York Philadelphia Trenton Philadelphia Teaneck	C. J. Schweikhardt, 150 E. State St., Trenton
New Mexico	June 20-25*†‡		G. D. Hastain, Box 1007, Clovis
New York	June 23, 24*	New York Buffalo	D. W. Beier, 23 S. Pearl St., Albany 7
	June 28-July 1*	New York Albany Syracuse Buffalo Rochester	
	Feb. 8†	New York Buffalo	
	Feb. 9, 10†	New York Albany Buffalo	
North Carolina	June 27*†	Chapel Hill	J. H. Guion, Doctors Bldg., Charlotte 7
North Dakota	July 11-15	Fargo	F. A. Maides, First National Bank Bldg., Grand Forks
Ohio	June 6-11* June 11† June 13, 14*† June 16-18*	Columbus Columbus Columbus Cleveland	D. E. Bowers, 322 E. State St., Columbus 15
Oklahoma	June 20-22* June 20, 22†	Oklahoma City	W. H. Stephens, Plaza Court Bldg., Oklahoma City
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Wyoming	June 20-23*†	Rawlins	W. J. Ryan, Boyd Bldg., Cheyenne

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Academy of Dentistry for the Handicapped	Feb. 7	Chicago	R. I. Kaplan, 3038 Federal St., Camden 5, N.J.
Academy of Denture Prosthetics	June 19-24	San Juan, Puerto Rico	W. L. Warburton, Medical Arts Bldg., Salt Lake City 11
Academy of General Dentistry	Feb. 9	Chicago	A. L. Knab, 8500 S. Stony Island Ave., Chicago
American Academy of Crown and Bridge Prosthodontics	Feb. 6, 7	Chicago	W. E. Corry, 2165 Adelbert Rd., Cleveland 6
American Academy of Dental Medicine	May 27-30	Philadelphia	J. T. Rothner, Medical Arts Bldg., Philadelphia or B. B. Saturen, 1930 Chestnut St., Philadelphia
American Academy of Dental Practice Administration	Feb. 4-6	Chicago	R. H. Campbell, 18595 Grand River, Detroit 23
American Academy of Occlusodontia	Feb. 6	Chicago	J. Kaplan, 4802 N. Broadway, Chicago 40
American Academy of Oral Pathology	Apr. 27-29	Chicago	R. J. Gorlin, School of Dentistry, University o Minnesota, Minneapolis 14
American Academy of Physiologic Dentistry	June 20-22	South Bend, Ind.	E. A. Lawton, 2217 Lincoln Way West, South Bend 28, Ind.
American Academy of Restorative Dentistry	Feb. 6, 7	Chicago	M. H. Mortonson, Jr., 735 N. Water St., Milwaukee 2
American Association for Cleft Palate Rehabilitation	May 12-14	Denver	D. C. Spriestersbach, University Hospitals, Iowa City
American Association of Dental Schools	Mar. 20-23	Chicago	R. H. Sullens, 840 N. Lake Shore Dr., Chicago 11
American Association of Endodontists	Feb. 5-7	Chicago	V. B. Milas, 2559 W. 63rd St., Chicago 29
American Association of Industrial Dentists	Apr. 25-27	Rochester, N. Y.	E. R. Aston, Pennsylvania Dept. of Health, P.O. Box 90, Harrisburg, Pa.
American Association of Orthodontists	Apr. 24-28	Washington, D.C.	E. E. Shepard, 8230 Forsyth Blvd., St. Louis 5
American Board of Dental Public Health	Oct. 13, 14	Los Angeles	D. J. Galagan, Divn. of Dental Public Health, PHS, Dept. of Health, Education and Welfare, Washington, D.C.
American Board of Oral Surgery	Apr. 1-4	Chicago	L. M. FitzGerald, Roshek Bldg., Dubuque, Iowa
American Board of Orthodontics	Apr. 18-23	Washington, D.C.	W. L. Wylie, University of California, School of Dentistry, Medical Center, San Francisco 22
American Board of Prosthodontics	July 25-30	Washington, D.C.	C. H. Jamieson, David Whitney Bldg., Detroit 26
American College of Dentists, Illinois Section	Feb. 7	Chicago	V. B. Milas, 2559 W. 63rd St., Chicago 29
American Dental Assistants Certification Board	May 11-15 Oct. 12-16		D. Thacker, 1419 "S" St., S.E., Washington 20, D.C.
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American Denture Society	Feb. 5, 6	Chicago	V. L. Steffel, College of Dentistry, Ohio State University, Columbus 10, Ohio
American Equilibration Society	Feb. 4	Chicago	R. C. Van Dam, 11431 S. Halsted St., Chicago 28
American Society for the Advancement of General Anesthesia in Dentistry	Mar. 28	New York	M. H. Feldman, 730 Fifth Ave., New York
American Society of Geriatric Dentistry	Feb. 8	Chicago	P. G. Rubens, 55 E. Washington St., Chicago 2
American Society of Oral Surgeons (Forty-second)	Oct. 12-15	Phoenix, Ariz.	D. C. Trexler, 840 N. Lake Shore Dr., Chicago 11
American Society of Psychosomatic Dentistry and Medicine	Mar. 11-13	Washington, D.C.	J. Caden, 5213 Connecticut Ave., Washington, D.C
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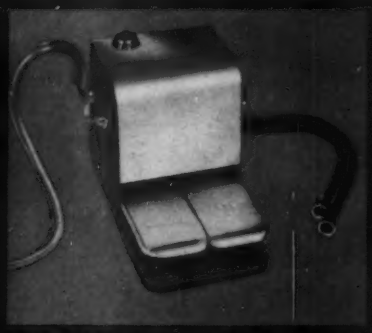

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British Dental Association	July	Edinburgh, Scotland	Secretary, British Dental Association, 13 Hill St., Berkeley Square, London W.1, England
Central Dental Association	Feb. 14-20	Aspen, Colo.	B. A. Gilbertson, Lowry Medical Arts Bldg., St. Paul
Chicago Dental Society	Feb. 7-10	Chicago	K. S. Richardson, 30 N. Michigan Ave., Chicago
Council on Dental Education, Dental Aptitude Tests	Apr. 22, 23		S. Peterson, 222 E. Superior St., Chicago 11
European Orthodontic Society (Thirty-Sixth Congress)	June 30-July 5	Belfast, Northern Ireland	H. T. A. McKeag, 35 Rugby Rd., Belfast, N.I.
Federation Dentaire Internationale, 43th Annual Meeting	June 20-25	Dublin, Ireland	G. H. Leatherman, 35 Devonshire Place, London W.1, England
Greater Philadelphia Annual Meeting	Mar. 8-11	Philadelphia	M. Kohn, Sheraton Hotel, 17th St. and Pennsylvania Blvd., Philadelphia 3
International Association for Dental Research	Mar.	Chicago	D. Y. Burrill, Northwestern University Denta School, 311 East Chicago Ave., Chicago 11
Italian Dental and Maxillo-Facial Congress (Third)	May 19-22	Palermo, Sicily	E. Tempestini, Dental Clinic, University o Palermo, Palermo, Sicily
Midwest Society of Periodontology	Feb. 7	Chicago	G. Roth, 1108 E. 10th St., Kansas City 10, Mo.
National Board of Dental Examiners	Mar. 28, 29		Grace Parkin, 222 E. Superior St., Chicago 11
National Dental Association	Aug. 1-5	St. Louis	E. N. Jackson, P.O. Box 197, Charlottesville, Va.
Northeastern Dental Society	June 5-8	Swampscott, Mass.	N. A. Emery, 291 Broadway, Lynn, Mass.
Northeastern Society of Orthodontists	Mar. 13-15	New York	D. Mossberg, 36 Central Park S., New York 19
Northwest Academy of Dental Medicine	May 19-22	Union, Wash.	G. Underwood, Selling Bldg., Portland 5, Ore.
Ontario Dental Association	May 15-18	Toronto, Canada	Mrs. W. C. Durham, 230 St. George St., Toronto 5 Canada
Pacific Coast Dental Conference, Eleventh Triennial	July 11-14	Portland, Ore.	K. R. Jensen, 1033 S.W. Yamhill St., Portland 5, Ore.
Pan American Congress of Children's Dentistry	Feb. 21-27	Bogota, Colombia	B. Gomez H., Sociedad Colombiana de Odontopediatria, Carrera 13, No. 41-58, Apartado Aerco 70-13, Bogota, D.E., Colombia
Pan American Council of Dentistry for Children Third Reunion	Feb. 21-27	Bogota, Colombia	B. Gomez H., Sociedad Colombiana de Odontopediatria, Carrera 13, No. 41-58, Apartado Aerco 70-13, Bogota, D.E., Colombia
Philippine Dental Association	May 11		D. G. Santos, P.O. Box 1142, Manila, Philippines
Southeastern Society of Oral Surgeons	May 12-14	Biloxi, Miss.	P. B. Whittington, Jr., Medical Arts Bldg., Greensboro, N.C.
Swedish Dental Society	Aug. 17-20	Stockholm	T. Telander, Nybrogatan 53, Stockholm, Sweden
Thomas P. Hinman Dental Meeting	Mar. 27-30	Atlanta, Ga.	T. J. Hicks, Jr., Doctors Bldg., Atlanta 8, Ga.
U.S.C. Dental Study Group of Mexico Thirteenth Annual Seminar	May 15-19	Acapulco, Mex.	G. Riquelme C., Paseo de la Reforma 95-803, Mexico 4, D.F.
Western Society of Periodontology	Mar. 27-29	Las Vegas, Nev.	H. A. Tyrrell, 1508 N. Sycamore St., Santa Ana, Calif.

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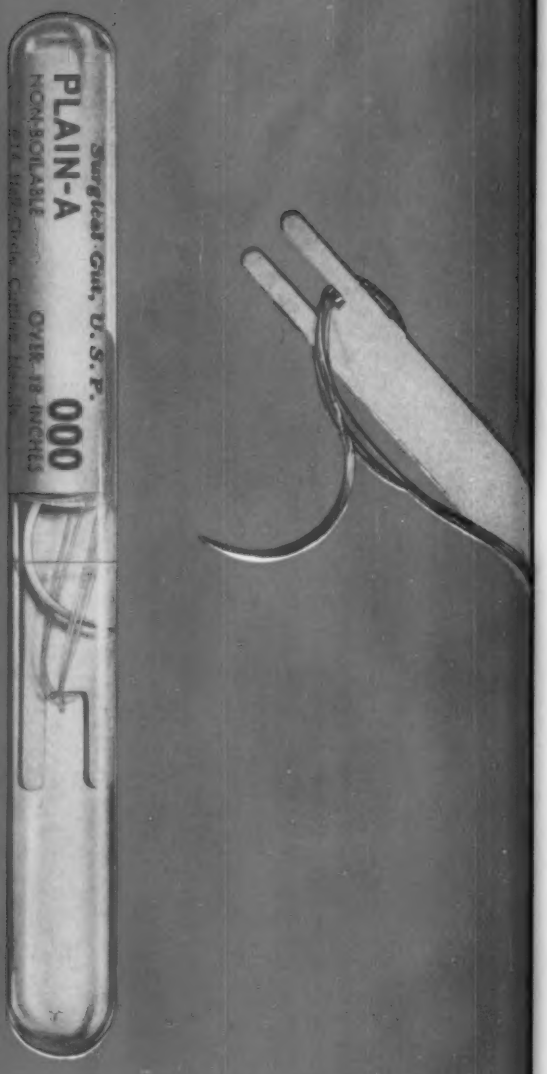

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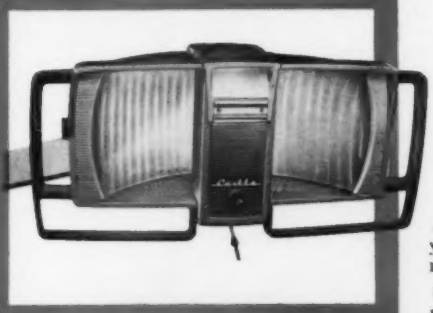

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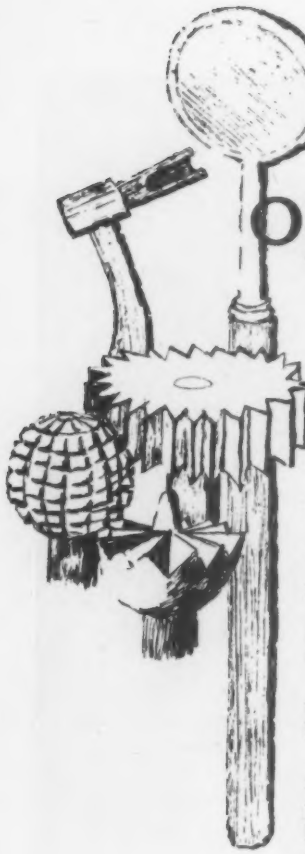

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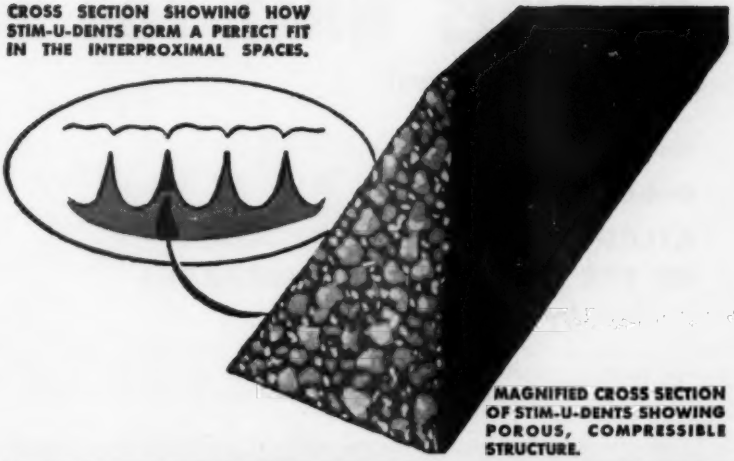

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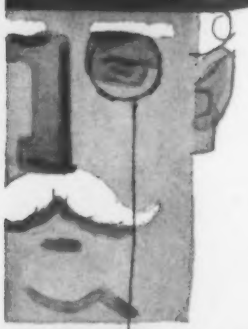

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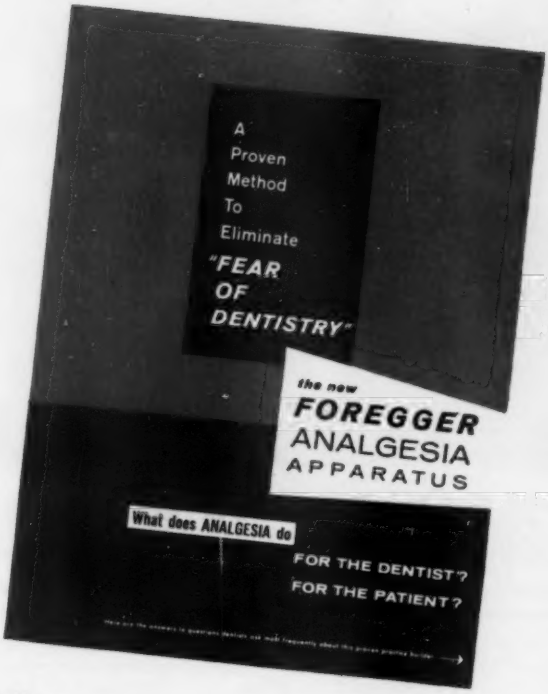

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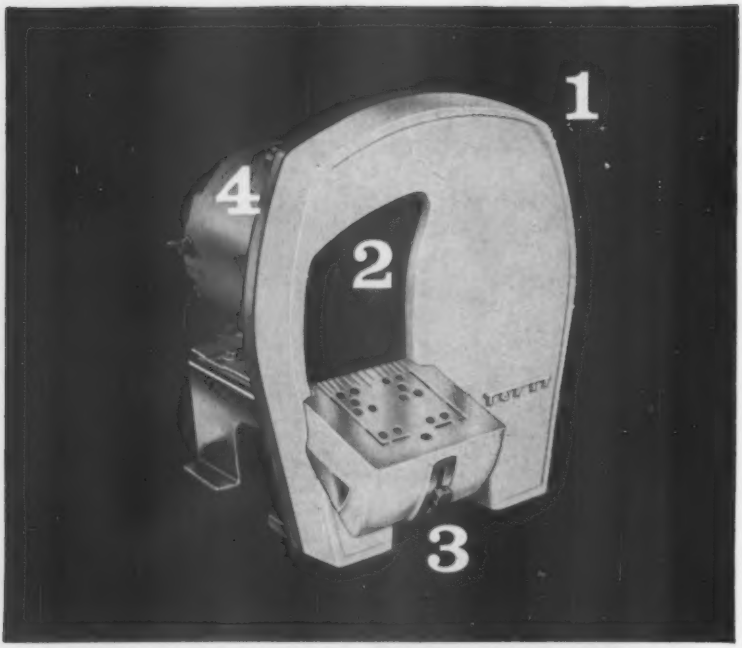

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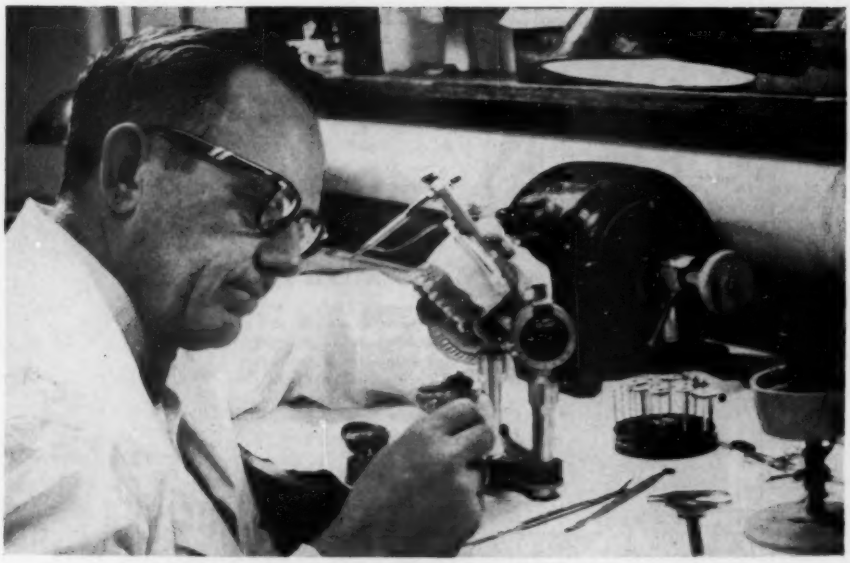

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3) Kimmelman, B. B., Tassman, G. C., and Tarin, B.: "Observations on Patients' Used Tooth Brushes," Journal N. J. State Dental Society, 31:2, 1959.

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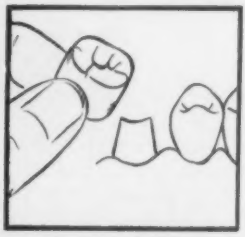
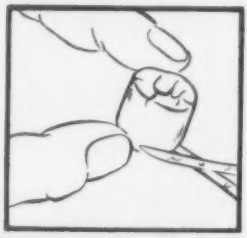
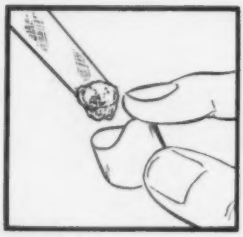


1 Select crown to fit snugly over prepared tooth



2 Cut crown gingivally to tooth height



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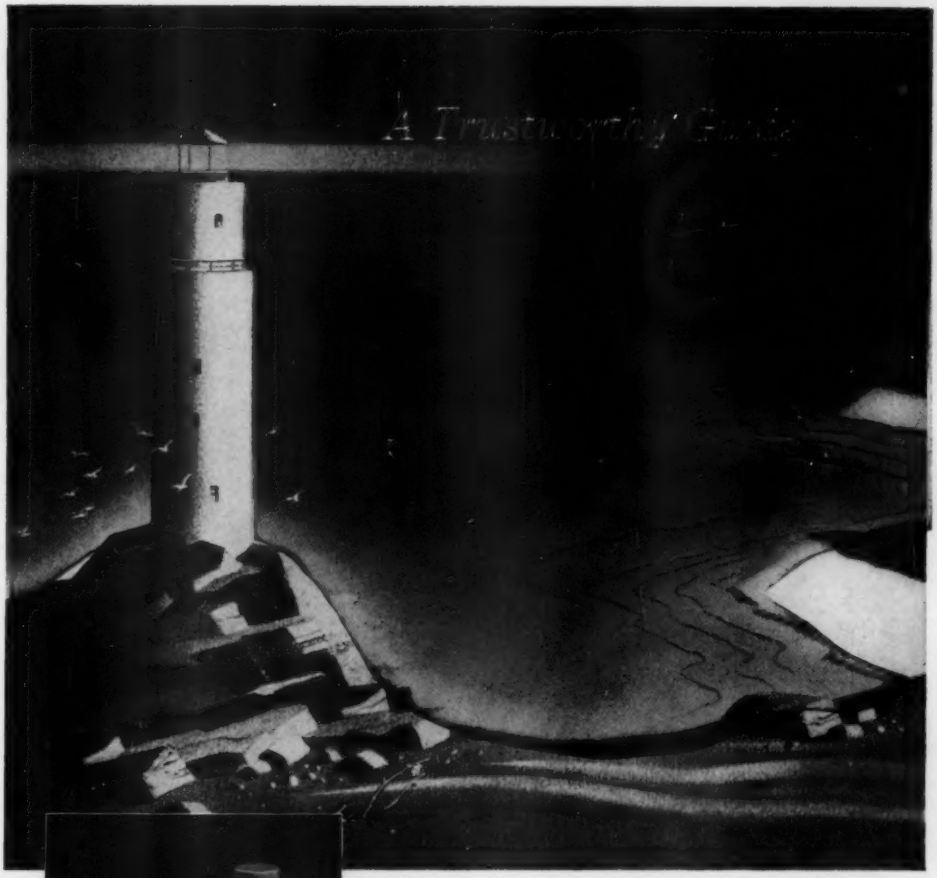

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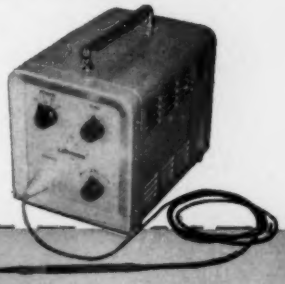

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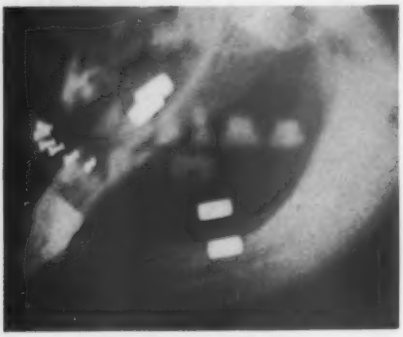

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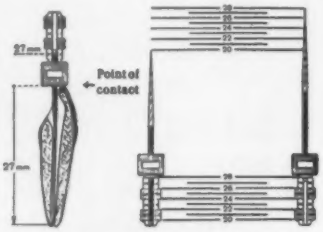

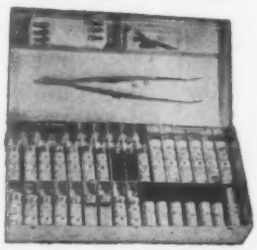

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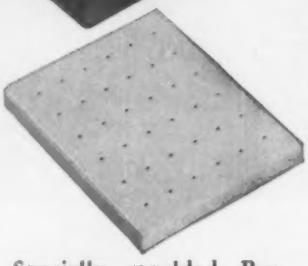

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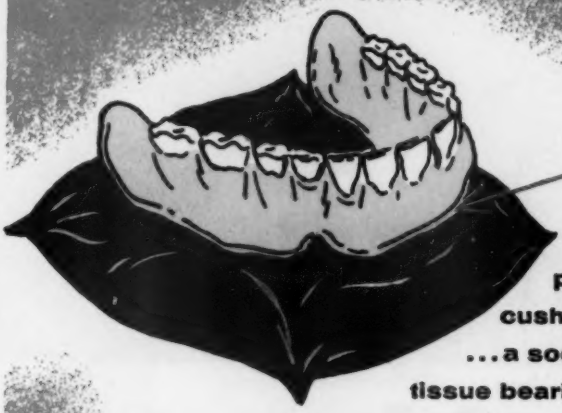

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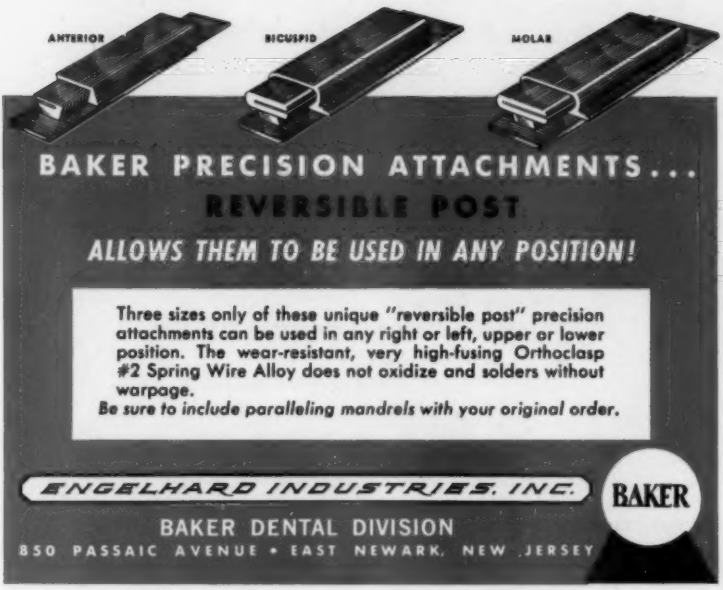
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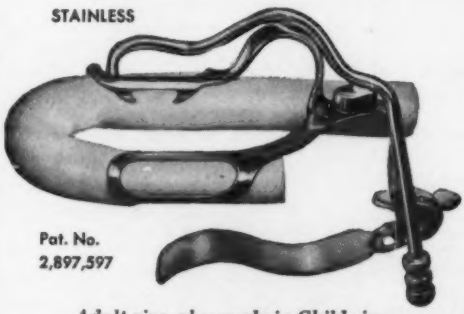

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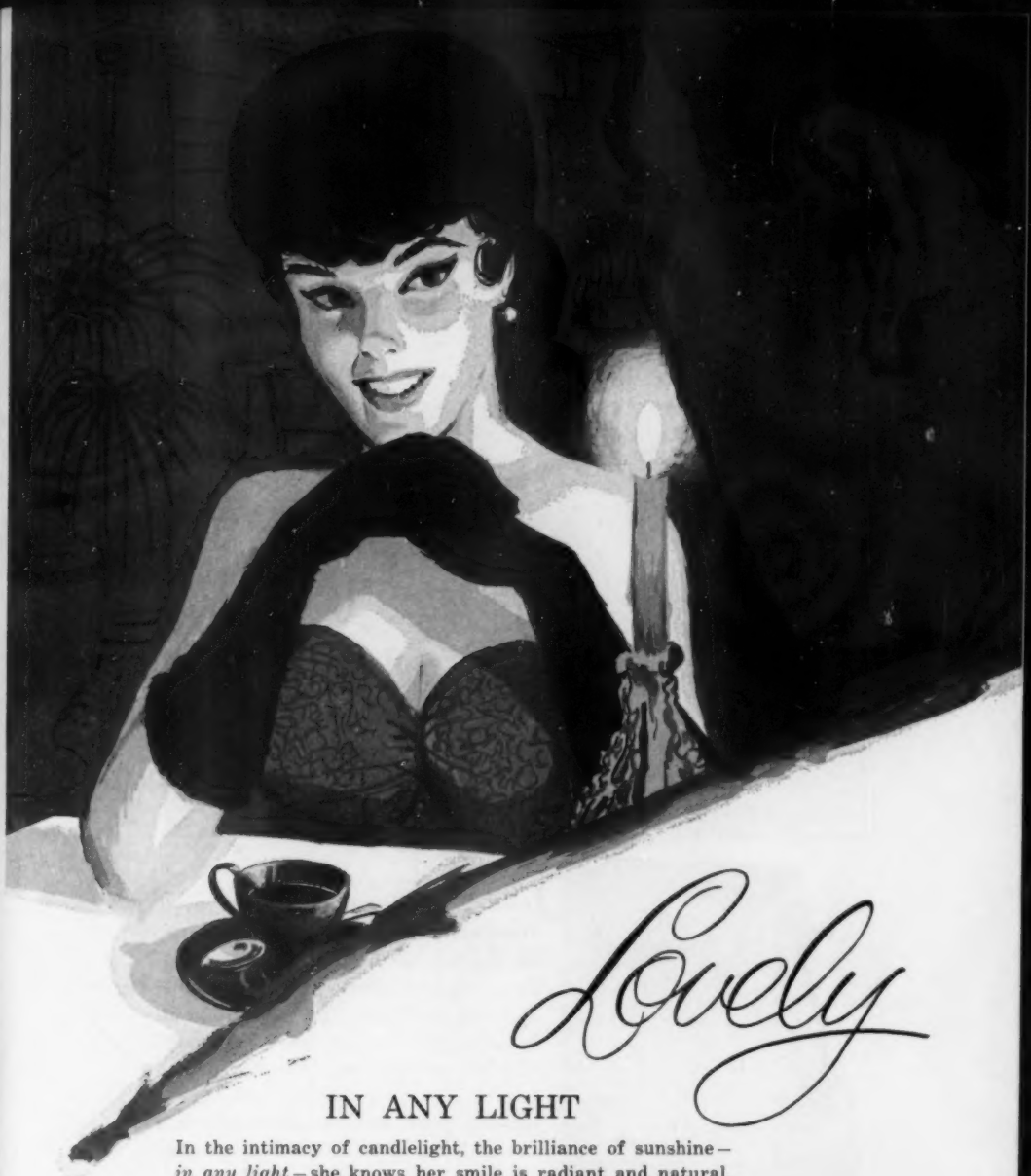

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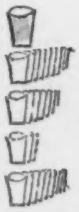

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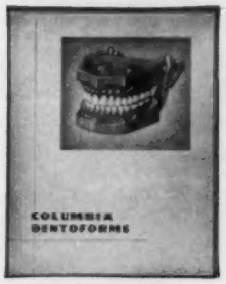

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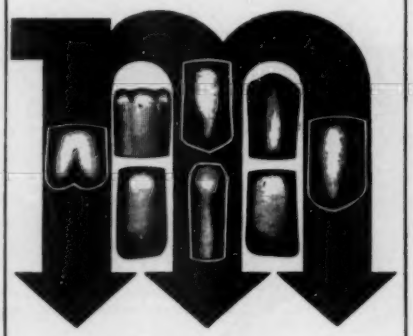

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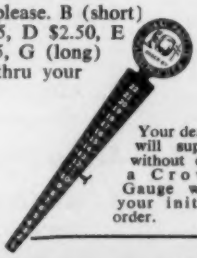

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ILLINOIS—Wanted. Associate in general practice. An excellent opportunity for right man. Must be highly skilled in gold work. Office located 12 miles south of Chicago. Must have completed military obligation. Give full details concerning experience, education and professional background. Address A.D.A. Box No. 716.

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Illinois licensed dentist, age 27, married, 1958 graduate, completing military obligation in June 1960. Interested in purchase, association or partnership. Address A.D.A. Box No. 721.

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OHIO—1955 graduate, married, military requirement completed. One year hospital internship. Desires position in industry, group practice, hospital or government. Presently in private practice. Address A.D.A. Box No. 723.

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Oklahoma licensed, 1958 University of Kansas City graduate with National Boards, age 31, married, will complete military obligation in August 1960, desires to associate in a busy, quality practice. Address A.D.A. Box No. 724.

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Pennsylvania licensed dentist married, age 29, military obligation completed, desires association with dentist or group with or without opportunity for future partnership or eventual purchase. Address A.D.A. Box No. 725.

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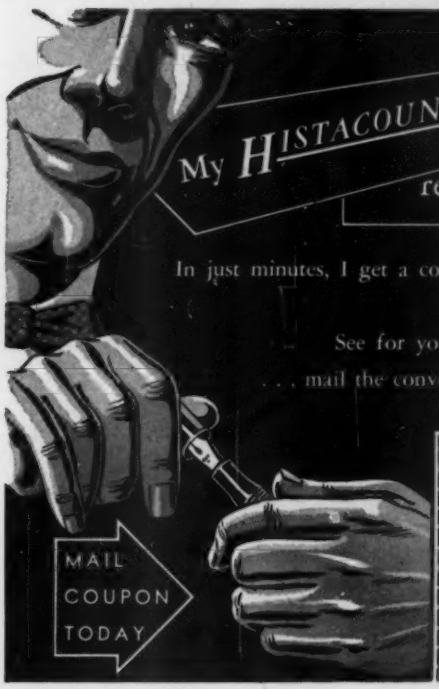

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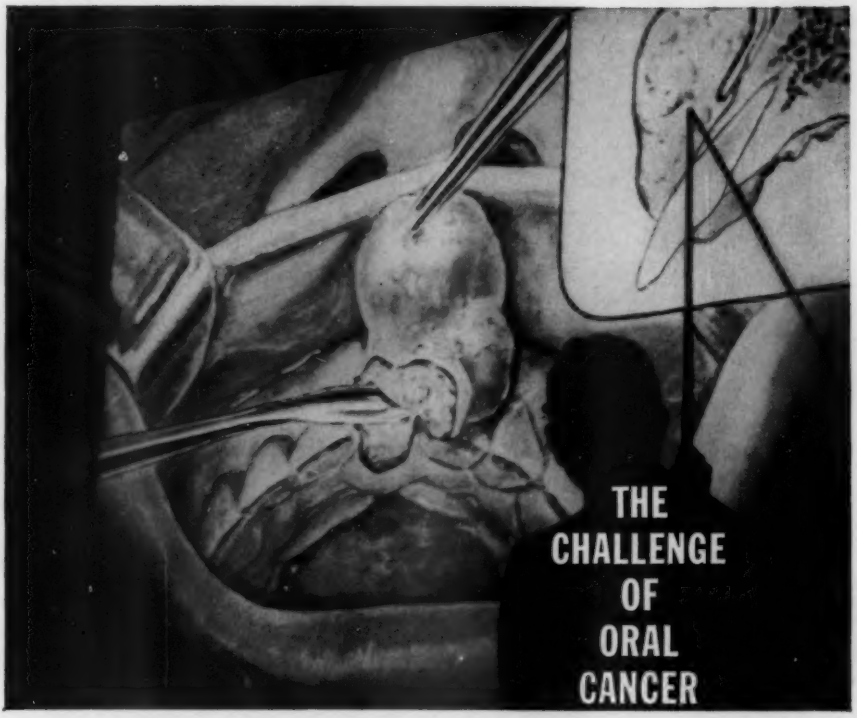

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Justice Department comments on revision of Association's policy on dental laboratory accreditation

COUNCIL ON DENTAL TRADE AND LABORATORY RELATIONS

The United States Department of Justice has informed the Association that the Department will not initiate "criminal proceedings against the American Dental Association or any of its constituent societies based solely upon the effectuation of the revised program" of dental laboratory accreditation approved recently by Association agencies. The Justice Department announcement and the modification of the Association's accreditation policy follow federal grand jury studies of relations between the dental profession and the dental laboratory group and a series of conferences between Association and Justice Department representatives.

Federal Grand Jury Subpoenas • In March 1957 a federal grand jury in Chicago caused a subpoena to be served on the Association requiring the production of certain Association records for examination by the grand jury. The Association documents requested in the subpoena related primarily to transactions between the dental profession and the dental laboratory group in the Chicago area. Subpoenas similar to that served upon the Association also were issued in March 1957 to the Illinois State Dental Society, the Indiana State Dental Association, the Chicago Dental Society, the Northwest Indiana Dental Society and the Illinois Dental Laboratory Association.

In mid-summer 1957, the Chicago grand jury caused subpoenas to be served on the Alabama Dental Association, the Dental Laboratory Association of Alabama, the Missouri State Dental Association and the Missouri State Laboratory Association. The subpoenas served on the Alabama Dental Association and the Missouri State Dental Association related specifically to documents associated with the dental laboratory accreditation programs conducted by those societies. In May 1958, a federal grand jury in Kansas City caused subpoenas to be served on a number of Missouri dental laboratory operators.

Conferences with Justice Department Officials • During the pendency of the grand jury studies, Association representatives conferred periodically with officials of the Justice Department. In a September 10, 1959, conference, Association representatives were informed that the Justice Department was considering the need to initiate civil litigation questioning the implementation by some constituent dental societies of the Association's policy on dental laboratory accreditation.

Association conferees were informed that litigation might be avoided if the constituent societies made appropriate modifications of their dental laboratory accreditation programs. In subsequent conferences between Justice Department and Association representatives the discussions centered around the following features of some constituent society dental laboratory accreditation programs:

Mandatory Membership • The Justice Department representatives questioned the legality of requirements alleged to be contained in some constituent dental society programs, making it necessary for a dental laboratory to join, or remain a member of, a particular dental laboratory association in order to gain and retain accredited status.

Delegation of Administrative Responsibility • The Justice Department representatives questioned the legality of the alleged delegation by some constituent dental societies of the administrative responsibility for a dental laboratory accreditation program to a nonprofessional agency, such as a dental laboratory group.

Program Publicity • The Justice Department representatives questioned the legality of the alleged publication by some dental societies of lists of accredited dental laboratories when coupled with editorial comment suggesting or recommending that the members of the dental society limit their patronage to the accredited dental laboratories.

Revision of Accreditation Policy • The 1959 House of Delegates authorized the Council on Dental Trade and Laboratory Relations, with the approval of the Association's Board of Trustees, to make whatever changes or refinements were deemed necessary to obviate any tenable legal objections to the Association's policy statement on dental laboratory accreditation. In response to the House directive and as a result of the series of conferences with Justice Department representatives, the Council and the Board of Trustees have approved the revision of the Association's policy statement captioned "Principles for Guidance of Constituent Societies in Formulating and Administering Programs for Accrediting or Approving Dental Laboratories" which is presented at the conclusion of this report.

Evaluation of Revised Policy Statement • The revised statement of the Association's dental laboratory accreditation policy was forwarded to the Justice Department on December 3, 1959, for evaluation and comment. In a letter dated January 7, 1960, addressed to Association Secretary Harold Hillenbrand, the Honorable Robert A. Bicks, acting assistant attorney general, Antitrust Division, Department of Justice, made the following comments:

> We have carefully considered the submission . . . entitled "Principles for Guidance of Constituent Societies in Formulating and Administering Programs for Accrediting or Approving Dental Laboratories," which . . . sets forth revisions approved by your Association's Council on Dental Trade and Laboratory Relations and Board of Trustees. We have concluded that we would not institute criminal proceedings against the American Dental Association or any of its constituent societies based solely upon the effectuation of the revised program which you have submitted.
>
> If your Association, or any of its constituent societies, in actual operation of such program, or as a result of other agreements, arrangements or practices, engages in activities beyond those set forth in your submission which raise questions under the antitrust laws, the Department of Justice reserves full freedom to proceed either criminally or civilly, or both, against any parties to such agreements, arrangements or practices, including your Association or any of its constituent societies to the extent of participation therein.
>
> It is further understood that, in foregoing the institution of criminal proceedings under the antitrust laws with respect to the submitted program as revised, we express no view and take no position with respect thereto under any law of the United States other than the antitrust laws.

In response to an inquiry on the status of the grand jury studies, Mr. Bicks advised, "The Department of Justice will maintain these matters in active status for a sufficient period of time to permit evaluation of action taken by the Asso-

ciation's constituent societies to revise their accreditation programs to conform with the revised statement submitted by the Association."

Constituent Society Action Urged • Constituent societies which have approved programs for accrediting dental laboratories are urged to examine their programs with a view toward eliminating or avoiding the program features to which the Justice Department representatives have indicated objection. Constituent societies which desire to establish programs for dental laboratory accreditation should follow the minimum requirements set out in the revised policy statement. Special care should be exercised on the following points in planning a program of dental laboratory accreditation:

1. Membership in a particular laboratory association should not be made a requirement for accreditation.
2. The responsibility for administering an accreditation program should not be delegated to a nonprofessional agency, such as a dental laboratory group.
3. Lists of accredited dental laboratories should not be published by the society together with editorial comment suggesting or recommending that members of the society limit their patronage to the accredited laboratories.

Before formal approval is given to a program on dental laboratory accreditation, the constituent society should obtain the opinion of its attorney on the legality of the proposed program under applicable state and federal laws. The Council on Dental Trade and Laboratory Relations will be pleased to consult with the constituent societies on the planning of dental laboratory accreditation programs.

PRINCIPLES FOR GUIDANCE OF CONSTITUENT SOCIETIES IN FORMULATING AND ADMINISTERING PROGRAMS FOR ACCREDITING OR APPROVING DENTAL LABORATORIES

(Revised December, 1939)

Policy • The American Dental Association reaffirms its position that properly planned constituent society programs for accrediting or approving dental laboratories, if given the wholehearted support of both dentists and dental laboratories, will prove to be the most practicable and effective device for improving the efficiency of dental laboratory services and for enhancing the profession's appreciation for, and confidence in, those dental laboratories which are continually striving to improve the quality and efficiency of their services to the profession. If successful, therefore, the program will serve to improve the quality and efficiency of the dentists' services to the public which is the primary aim of the American Dental Association and its constituent societies.

The American Dental Association does not accredit or approve dental laboratories. The Association does, however, urge its constituent societies to give consideration to the establishment of programs for accrediting or approving dental laboratories within their own jurisdictions. The principles that follow are intended to serve as guides to clarify the fundamental purpose and philosophy of such a program.

Planning the Program • Before a constituent society adopts and puts into effect a program for accrediting or approving dental laboratories, the appropriate agency of the society should be assigned to draw up a formal plan to govern the operation of the program. That plan should include a statement of the program's purpose, the requirements to be met by applicant dental laboratories, the methods and procedures for determining an applicant dental laboratory's compliance with the program's requirements, and the advantages to be accorded to accredited or approved dental laboratories. Before the plan is put into final form for presentation to the society for adoption, the agency in charge of the project should invite representatives of the laboratory group to offer whatever recommendations they may see fit to suggest.

Purpose of Program • The purpose of a constituent society program for accrediting or approving dental laboratories should be to develop and maintain a mutually helpful relation between the dental profession and the dental laboratories (1) by encouraging dental labo-

ratories to improve the quality and efficiency of their services, and (2) by providing to dentists a means of selecting a dental laboratory whose standards of service meet the requirements established by the constituent society.

Basis Upon Which Accreditation or Approval Should Be Determined • The accreditation or approval of a dental laboratory by a constituent society should be based upon the laboratory's compliance with the following minimum requirements:

1. Evidence that the applicant dental laboratory's services are of reasonably high quality.
2. Evidence that the applicant dental laboratory's facilities and equipment are adequate to render in an efficient and satisfactory manner the types of services it offers to the profession.
3. Evidence that the dental appliances fabricated or processed by the applicant dental laboratory conform to the designs, directions, or instructions furnished by the dentists who order the appliances.
4. Evidence that the applicant dental laboratory is observing the provisions of state and federal statutes relating to the advertising, processing and delivery of dental appliances.

Membership in a dental laboratory association shall not be required as a condition for accredited status under any constituent society program for accrediting dental laboratories.

Methods and Procedures for Determining Compliance With Requirements • The establishment of an accreditation program and the inspection methods and other procedures to be followed in determining whether a dental laboratory meets the requirements of the program are the responsibility of the constituent society. This responsibility must not be delegated.

Advantages To Be Accorded to Accredited or Approved Dental Laboratories • A major objective of the program is to provide to dentists a means of selecting a dental laboratory whose standards of service meet the requirements established by the dental profession. Therefore, in addition to furnishing a certificate to each accredited or approved dental laboratory, the constituent society should permit the accredited or approved dental laboratory to report that fact in its advertisements.

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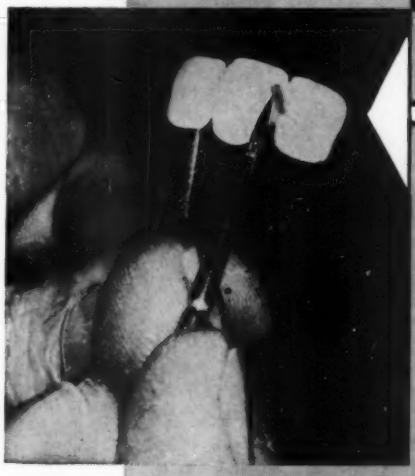

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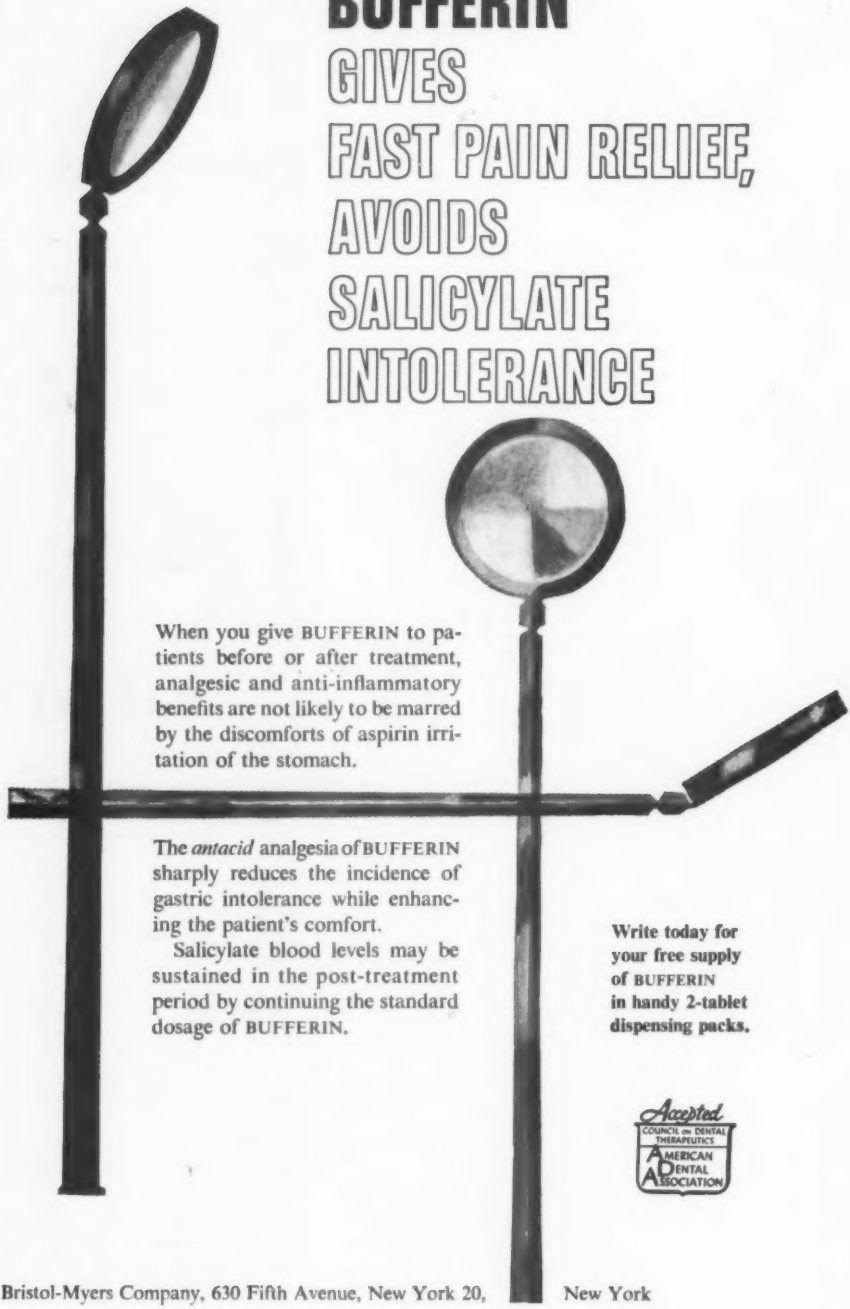

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